FORAMINIFERA

BY

A. C. COLLINS,
Geelong, Victoria.

1 OCT 1958

BRITISH MUSEUM NATURAL HISTORY

WITH THREE TEXT-FIGURES AND FIVE PLATES.

CONTENTS.

PAGE
Introduction 335
Description of Material 336
List of Proposed New Genera 340
List of New Species and Subspecies 340
Systematic Account 341
Previous Work in the Region 427
Zoogeographical Relationships 428
Depth Indications in Relationship to Reef Borings 429
List of Literature 430

INTRODUCTION.

This report deals with the foraminifera collected at Low Islands and other Barrier Reef localities by the Great Barrier Reef Expedition of 1928–29. The material was entrusted to the late W. J. Parr, F.R.M.S., with the present author as collaborator, in 1949. Unfortunately, before the material was received, Parr was stricken with the illness which led to his untimely death on the 21st August, 1949, and the present author was left to carry out the work without the benefit of Parr's long experience and deep knowledge of the foraminifera of the Australian region.

Much of the material had been washed down and graded by the late Mr. A. Earland, who at the time prepared short notes on the general characteristics of the samples. I am glad to acknowledge the value of these notes, which have been incorporated in the descriptions following. I also owe thanks to Mr. Earland for the opportunity of examining a beautiful series of mounted specimens from the classic locality of "Challenger" Station 185, Raine Island, sent by him originally to W. J. Parr, which has materially assisted the present work.

The samples of sediments received were of a heterogenous nature and were obviously collected incidentally to other work, and without any systematic plan which might have thrown light on the ecology of the foraminifera present. This is not surprising, since at the time of collection the detailed ecological and quantitative study of foraminiferal distribution was little, if at all, practised. Consequently, the present report is confined almost entirely to faunal record, which is in any case needed in this region as a basis for more detailed studies.

A large proportion of the samples consisted of current- and wave-sorted coral sand from the inter-tidal zone, in which the foraminifera present were mostly badly-eroded specimens of the stronger and heavier shallow-water species. The collection of reef specimens from sheltered locations, bearing sessile species, was apparently not attempted in relation to foraminifera, and in general such forms were only found where dredged samples included fragments of shells and calcareous algae forming bases for attachment.

Somewhat less than half the samples were dredged in shallow water, ranging from low-tide level to 28 fathoms. These samples in most cases yielded large and varied assemblages, including many new species and interesting records. In addition, there were three samples from medium depths, one of which (no. 45), from a depth of 600 metres, yielded a rich and varied assemblage of medium-depth benthonic species together with oceanic pelagic forms.

A total of 391 species and subspecies is recorded from the material, of which 46 are described as new.

DESCRIPTION OF MATERIAL.

Fifty-nine samples were submitted for examination. The system of labelling was found to be rather confusing, and in the end the samples were serially numbered 1 to 59, the Expedition station number being quoted in the description of each sample. Fifty sets of station slides were mounted, the remaining nine samples being either barren of foraminifera or otherwise not worth mounting.

The ecological data available is sufficient only for drawing the broadest conclusions as to local distributions. However, considering the samples broadly, they fall into four groups of some ecological significance, as follows :—

Group 1.—Mangrove-swamp pools, from the interior of Low Island. Samples 1, 5, 6, 9, 10, 11, 13 and 14. The foraminifera present are nearly all common shallow-water species, the larger forms usually eroded after transportation by wave action. However, there are a few species which are consistently found in greater relative numbers in these samples than in those from adjacent shallow-water deposits. This would appear to indicate that these species are actually living in the mangrove pools, though not confined to them ; having developed a tolerance of the wide temperature and salinity ranges which tend to operate in these conditions. Such species are : *Ammomarginulina australiensis* n. sp., *Quinqueloculina milletti* (Wiesner) and *Triloculina littoralis* n. sp.

Group 2.—Reef Flat collections. Samples 2, 3, 4, 7, 8, 12, 15, 16, 17, 18, 19, 20, 21, 22, 48, 53, 55, 56, 57, 58 and 59. These range from beach sands to shallow-water sediment collections and have the general characteristics of being wave- and current-sorted and subjected to considerable attrition. As with most Queensland coral sands, the discoidal foraminifer *Marginopora vertebralis* Quoy and Gaimard is dominant in the coarser fractions, while the stellate species *Baculogypsina sphaerulata* (Parker and Jones) is frequently found in a fresh and unworn condition, indicating its existence in the living state in this environment. In general, these samples are of little interest, their foraminiferal content being mainly a selection of the more resistant tests from adjacent shallow-water deposits. The best preserved material was obtained from one of the samples taken in the process of estimating the rate of sedimentation on the reef flat and in the lagoon.

Group 3.—Shallow-water dredgings. Samples 23, 24, 25, 26, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 40, 41, 42, 43, 44, and 47. These are from depths ranging from low-tide level to 28 fathoms. Some consisted of small collections of larger foraminifera selected from the dredging, while others were washed muds which yielded larger assemblages of smaller forms in perfect condition. While the assemblages had much in common, there were differences which may have been due to current-sorting or to ecological factors such as the nature of the bottom. To evaluate these differences, systematic collection by a quantitative method capable of statistical interpretation is needed. As this condition is lacking, no such attempt has been made. The fauna of these bottom samples is the typical shallow-water assemblage of the region, from which the thanatocoenoses of Groups 1 and 2 were obviously derived.

Group 4.—Deeper-water dredgings. Samples 39, 45 and 46. No. 39 was dredged at 210 fathoms, while nos. 45 and 46 were accidental collections at 600 metres and 205 metres respectively, derived from the bottoming of tow-nets during plankton investigations. The assemblages of these samples, as might be expected, was distinctively different from those of Group 3, deriving as they did from the deeper waters of the continental shelf. Many species were identical with those found at similar depths as far south as Tasmania, and it appears probable that still greater correlation will be found when the off-shore deposits of the eastern Australian coast have been more exhaustively examined.

In addition, there were four miscellaneous samples, Nos. 49, 50, 51 and 52 for which localities were not given. They were in any case of little interest.

To avoid cumbering the report with statistics of no ecological or other useful significance the distribution of species listed in the systematic account is given in terms of the groups 1 to 4 described above. Reference to the occurrence of a species in the samples of a particular group does not, of course, mean that it occurs in all the samples of that group, as some are composed of coarse fractions only and others consist of pre-selected specimens of the larger forms. Such references should be taken to mean that the species occurs generally in samples large enough to include a representative faunule and containing material of the appropriate size grade for the species under consideration. Precise locations are of course quoted in the case of new species, and where locality is of some special significance.

SAMPLE LISTS.

Note.—Serial numbers have been given by the author. Symbols, where quoted, refer to the " Key Chart of Low Isles ".

Sample No.

1. P.5. Channel into mangrove swamp. About 100 c.c. of coarse and dirty sand in spirit. Foraminifera worn and eroded.
2. F.8. Reef flat. About 40 c.c. of coarse sand in spirit, black and foetid. Foraminifera mostly worn and eroded, *Tinoporus* and *Baculogypsina* predominating.
3. F.8. Reef flat. 25 c.c. coarse calcareous sand, dry. Foraminifera few and worn.
4. F.6. Reef flat. 20 c.c. coarse calcareous sand, dry. Few foraminifera, no slide mounted.
5. Mangrove Park. 32 c.c. dry calcareous sand with some fine material. *Baculogypsina*, *Tinoporus* and *Amphistegina* dominant in coarse fractions, Miliolidae in the finer fractions.
6. Between F.5 and the Mangrove Park. 35 c.c. dry calcareous sand, coarse and fine. Smaller forms better preserved than in sample 5.
7. F.5. Reef flat. 30 c.c. dry calcareous sand, mostly coarse. A few well-preserved smaller species.
8. The Sand Flat. 25 c.c. dry coarse calcareous sand. Finer fractions contained a small assemblage of foraminifera.
9. I.M.1. Inside mangrove swamp. 32 c.c. muddy calcareous sand, mostly fine. Floatings contained large quantities of vegetable fibre. Foraminifera fall into three groups—shallow-water forms such as *Marginopora*, usually eroded ; pelagic forms such as *Cymbaloporetta*, obviously tide-deposited ; and a few species which by their fresh condition and relative abundance suggest that they find the muddy pools of the mangrove swamps a specially favourable habitat. This sample was fairly typical of those of Group 1.
10. Mangrove Park. 32 c.c. muddy calcareous sand, a mixture of coarse and fine. Generally similar to no. 9.
11. Mangrove Park. 30 c.c. material similar to 9 and 10.

12. Clam Spit. 23 c.c. coarse calcareous sand. A few larger foraminifera, badly worn. Fine material mostly alcyonarian spicules. No slide mounted.
13. M.13. Mangrove Park. 30 c.c. coarse calcareous sand in spirit, containing *Baculogypsina*, *Tinoporus* and *Marginopora*.
14. M.7. Mangrove Park. 35 c.c. material similar to No. 9.
15. Porites Pond. 40 c.c. dry calcareous sand, with few foraminifera.
16. North-east Moat. 30 c.c. dry calcareous sand, coarse and fine, wave- and current-sorted sediments with an assemblage of shallow-water foraminifera.
17. Western Moat. 40 c.c. coarse beach sand in spirit, generally similar to 16.
18. Labelled " South Eastern Moat ", a reference which is not found on the Key Chart of Low Isles. 40 c.c. coarse calcareous sand, containing worn larger foraminifera.
19. The Madrepore Moat. 30 c.c. calcareous sand in spirit, foraminifera common, mostly worn specimens of the larger species.
20. Labelled " Railway Spit ", a reference which does not appear on the Key Chart. 27 c.c. coarse coral sand. No slide mounted.
21. Labelled " North West Shore of Island ". 25 c.c. dry calcareous sand, coarse and wind-polished. No slide mounted.
22. P.1. Luana Creek, Luana Harbour. 70 c.c. coarse calcareous sand in spirit, containing worn specimens of larger foraminifera.
23. Off NNW. Low Isles, 5–6 fathoms. 50 c.c. fine muddy sand in spirit. Many species of shallow-water foraminifera in medium fractions, most of the remainder being fine angular sand passing 150 mesh.
24. Off NNW. Low Isles, about 10 fathoms. 50 c.c. fine muddy sand in spirit. Foraminifera varied and abundant, other organic remains including radiolaria, diatoms, a holothurian anchor plate, alcyonarian and sponge spicules, and pteropod and other molluscan shells.
25. Mud from 8 fathoms, about ½ mile NW. of Low Isles. Generally similar to no. 24.
26. Boulder Tract. 45 c.c. dark muddy sand, collected from between coral " niggerheads " outside western rampart, and containing a large assemblage of shallow-water foraminifera, also diatoms, alcyonarian spicules and pteropod shells.
27. Boulder Tract. Practically a duplicate of no. 26.
28. The Anchorage. 75 c.c. dark muddy sand, depth probably not more than 20 ft. Alcyonarian spicules account for about 30 per cent of the washed material. Large assemblage of shallow-water foraminifera, mostly Miliolidae and Rotaliidae.
29. Jukes Reef, anchorage zone. (A linear reef of the Outer Barrier, lying in lat. 14° 35′ S.) 50 c.c. coarse white coral sand in spirit, probably from shallow water *ca.* 20 ft. An interesting foraminiferal assemblage with many sessile forms and the rare genus *Ungulatella*.
30. Duplicate of no. 29.
31. Dredge Stations II and III, Linden Bank, 28 fathoms, shell and sand. A small tube containing large specimens of *Operculina*, *Marginopora* and *Discobotellina*.
32. Dredge Station IV, Linden Bank, 38 fathoms, mud. About 5 c.c. of coarse material consisting of mollusca, bryozoa and large specimens of *Operculina*. the latter forming the bulk of the material. A few other large foraminifera were present, and a very small quantity of fine material yielded a surprisingly large list of species.
33. Dredge Station V, Linden Bank, 37 fathoms, mud. A small tube containing *Marginopora*, *Operculina* and *Discobotellina*.
34. Dredge Station VIII, 1½ miles NW. of Low Isles, 11 fathoms, mud. 5 c.c. fairly fine coral sand, containing a large assemblage of smaller shallow-water species.
35. Dredge Station XI, vacuum grab, inside Wentworth Reef, 7 fathoms, mud and rock. There is some confusion due to two labels, one Stn. XI and one Stn. IX, accompanying this sample. No grab is recorded for either station. XI has been accepted as the station for this sample, as the label recording this is in ink and dated, the other being a rough pencil note. A small quantity of foraminiferal sand, washed from a fine mud in spirit, containing a fair assemblage of foraminifera, some large diatoms and radiolaria.
36. Dredge Station XII, vacuum grab, Penguin Channel, 10–15½ fathoms, rock and shell gravel, mud in edges of pit. 50 c.c. of fine brown mud in spirit. Residue two-thirds coral sand with a rich foraminiferal assemblage, one-third fine angular sand passing 120 mesh.
37. Dredge Station XIII, ½ mile west of Two Isles, 16½ fathoms, hard. Coarse coral sand in spirit, with some fine material. Foraminifera abundant, particularly larger species.

38. Dredge Station XIV, ½ mile south-east of Lizard Island, 19 fathoms, shell gravel. A small quantity of coarse debris in spirit, with a variety of well-preserved larger foraminifera.

39. Dredge Station XV, ½ mile outside Cook Passage, drifting north, 210 fathoms, clean sand and coral debris. About 5 c.c. whitish cemented material, containing a small assemblage of pelagic species and benthic Rotaliidae.

40. Dredge Station XVI, about ½ mile west of North Direction Island, 20 fathoms. A small quantity of washed material, coarse and fine, containing a representative shallow-water assemblage.

41. Dredge Station XIX, about ½ mile north of Eagle Island, 10 fathoms, shell gravel, rich *Halimeda*. One tube of coarse washed material containing a variety of larger foraminifera, together with molluscan and algal debris.

42. Dredge Station XXI, ½ mile north-west of Howick Islands, 10 fathoms, mud and shell, foraminifera. Three tubes of larger foraminifera, mainly *Marginopora*, *Alveolinella* and *Operculina*, with a small amount of finer material yielding a fair assemblage of smaller species.

43. Dredge Station XXII, to East of Snake Reef, 13½ fathoms, mud with foraminifera and shells. A tube of light grey coarse material with some mud, the coarser fraction mainly foraminifera including *Operculinella*, together with molluscan, algal and alcyonarian debris.

44. Dredge Station XXIII, in lee of Turtle Islands, 8 fathoms, mud and shell. A small quantity of coral sand with a fairly large shallow-water foraminiferal assemblage.

45. " Outside Trinity Opening, Nov. 23rd, 1929, 600 metres. " Five small bottles of cleaned material, mostly fine. This material was received direct from Mr. Earland. It corresponds in date, position and depth with Plankton Station 28, and presumably is the result of a tow-net touching bottom, though this is not recorded for this station. Foraminifera are varied and abundant, including both pelagic and benthic species. The latter include species usually found in deeper water and also many others characteristic of the shallow reef area, these being pauperate in comparison with specimens from shallower water. Other organisms include pteropod shells, providing a base for many sessile foraminifera, also mollusca, ostracoda, echinoid spines, sponge spicules, radiolaria and diatoms.

46. Plankton Station 29 (bottom). Outside Trinity Opening. A small amount of coarse material, containing six specimens of *Heterostegina operculinoides* Hofker and one of *Cycloclypeus carpenteri* Brady, the remainder being shell fragments.

47. Dredging, Penguin Channel, 16 fathoms, mud, 2.xii.28. There is no record of this collection in either the dredging or tow-net list. One tube containing *Marginopora* and *Discobotellina*.

48. Sand from patch No. 1, Batts Reef. One tube of coral sand with a small but typical shallow-water assemblage, the larger species eroded.

49. Washings from *Tubipora*, no locality. 20 c.c. of *Tubipora* fragments with a small amount of finer material containing a good deal of vegetable fibre. Foraminifera were mostly juvenile specimens.

50. General Survey M.8, sandy foraminifera on *Thalassia*. A ribbon-like frond with circular whitish marks corresponding in size to small detached specimens of *Marginopora* in the same tube, which were evidently attached when collected. No arenaceous forms were present. No slide was mounted.

51. " Great Barrier Reef of Australia." One small tube of material consisting almost entirely of specimens of *Baculogypsina, Tinoporus, and Amphistegina*. No slide mounted.

52. " Foraminifera from *Halimeda*." A tube of well-preserved specimens of *Marginopora*, evidently collected in the living condition from attachment to *Halimeda*. No slide mounted.

53. " Sediment IV 5a." A jar and three tubes of washed material ranging from coarse to fine. This and the following six samples presumably derive from collections made in the process of determining the rate of sedimentation in different parts of the reef flat. This sample contained a fairly large assemblage of shallow-water foraminifera, better preserved than in the case of beach collections.

54. " Sediment, A.22, 5.5.29–12.5.29." A small quantity of grey tenacious clay containing vegetable fibre and a small assemblage of foraminifera which had a good deal in common with the mangrove-pool samples, small Miliolidae and Cymbaloporidae predominating.

55. " Sediment B.22, 5.5.29–12.5.29." Two tubes of coarse material, mostly algal and molluscan fragments, with a small shallow-water foraminiferal assemblage.

56. " Sediment C.22, 5.5.29–12.5.29." One tube of material similar to no. 54.

57. " Sediment D.22, 5.5.29–12.5.29." One tube of material similar to 54, but containing a good deal of flocculent organic matter and fibre, leaving a very small residue with a few foraminifera. No slide mounted.

58. " Sediment E.21, 5.5.29–12.5.29." One tube containing a felted mass of green algal threads coagulated with mud, leaving a very small sandy residue with a few foraminifera. No slide mounted.
59. " Sediment F.1, 5.5.29–12.5.29." One tube of dark brown hardened material consisting almost wholly of vegetable fibre and giving a strong red-brown solution when boiled with soda. Probably derived from mangrove debris. No slide mounted.

All of the above material was received in the dry condition, the samples originally preserved in spirit having been cleaned and washed down by Mr. Earland.

LIST OF PROPOSED NEW GENERA.

DISCOBOTELLINA, type species *D. biperforata* n. sp., Astrorhizidae.

EDENTOSTOMINA, type species *E. cultrata* (Brady), Miliolidae.

NUBECULOPSIS, type species *N. queenslandica,* n. sp., Ophthalmidiidae.

GLOBULOTUBA, type species *G. entosoleniformis,* n. sp., Polymorphinidae.

LIST OF NEW SPECIES AND SUBSPECIES.

Discobotellina biperforata n. sp.
Proteonina cushmani n. name.
Glomospira elongata n. sp.
Lituotuba minuta n. sp.
Ammomarginulina australiensis n. sp.
Nouria textulariformis Hada, *armata* n. subsp.
Trochammina chitinosa n. sp.
Gaudryina (*Pseudogaudryina*) *concava* n. sp.
Eggerella australis n. sp.
E. polita n. sp.
Dorothia inepta n. sp.
Karreriella (*Karrerulina*) *attenuata* n. sp.
Quinqueloculina crassicarinata n. sp.
Q. cuvieriana d'Orbigny, *queenslandica* n. subsp.
Q. quinquecarinata n. sp.
Massilina subrugosa n. sp.
M. secans d'Orbigny, *tropicalis* n. subsp.
M. corrugata n. sp.
M. minuta n. sp.
Spirosigmoilina bradyi n. sp.
S. parri n. sp.
Articulina tricarinata n. sp.
A. queenslandica n. sp.
Hauerina pacifica Cushman, *rugosa* n. subsp.
Triloculina littoralis n. sp.
T. quadrata n. sp.
Nodophthalmidium gracilis n. sp.
Ophthalmidium circularis Chapman, *tropicalis* n. subsp.
Planispirinella involuta n. sp.
Nubeculopsis queenslandica n. gen., n. sp.
Globulotuba entosoleniformis n. gen., n. sp.
Glandulina semistriata n. sp.
Buliminella latissima n. sp.
Bulimina oblonga n. sp.

Globobulimina australiensis n. sp.
Trimosina milletti Cushman, *multispinata* n. subsp.
Bolivina alata Seguenza, *fimbriata* n. subsp.
Bifarina queenslandica n. sp.
Discorbis subvesicularia n. sp.
Conorbella earlandi n. sp.
Discorinopsis tropica n. sp.
Patellinella carinata n. sp.
Epistomariella milletti n. sp.
Streblus convexus n. sp.
Robertina australis n. sp.
Elphidium pacificum n. sp.

SYSTEMATIC ACCOUNT.

Recent researches by Wood, Hofker and others have indicated that a satisfactory natural classification of the foraminifera is still to be attained. The long-standing classification of Cushman (1928–48) though widely known and used, has features which are not acceptable in the light of present knowledge, though no other published classification has approached it in completeness. The classification of Chapman and Parr (1936) suffers from basic errors derived from a misconception of the antiquity of certain genera, since clarified by Wood (1947). The important petrological research by Wood into the shell-structure of foraminifera has yet to be fully evaluated in its effect on classification, while the more recent work by Hofker on the minute morphology of the foraminiferal test must have a profound effect on the understanding of natural relationships, once the unfortunate difficulties introduced by invalid nomenclature are resolved.

For the purposes of this report the author has adopted in general the classification of Glaessner (1947). Additional families and subfamilies have been added where the original scheme made no provision for certain recent forms, and other changes have been made where more recent work has indicated the necessity, such as the removal of the genera *Nonion* and *Nonionella* to the Chilostomellidae on the basis of shell-structure as elucidated by Wood. For the superfamily Rotalidea, the recent classification of Bermudez (1952) has been followed, with the exception noted above.

Superfamily ASTRORHIZIDEA.

Family Astrorhizidae.

Subfamily Astrorhizinae.

Genus *Astrorhiza* Sandahl, 1858.

(1) *Astrorhiza* sp. cf. *arenaria* Norman.

cf. *Astrorhiza arenaria* Norman, 1876, Proc. Roy. Soc. XXV, p. 213; Brady, 1884, p. 232, pl. xix, figs. 5–10.

Four specimens from sample 45, one furcate, the others variously rounded or flattened, are doubtfully referred to this species. They are rather small, *ca.* 3 mm. in length, but otherwise resemble “ Goldseeker ” specimens in the author’s possession.

Form 2, in which the test is ellipsoidal in outline and has two slot-like holes penetrating the test from side to side, regularly spaced at approximately the third points of the major diameter, and set a little to one side of the longer axis. The outer fine-grained layer is continuous through these holes.

(6) *Diseobotellina biperforata* n. sp.

(Plate I, figs. 1*a*, *b* ; 2*a*, *b* ; 3.)

Species with the characters of the genus.

Holotype from 4–6 fathoms, Moreton Bay, South Queensland.

Dimensions of holotype : Major diameter 20·5 mm., minor diameter 18·0 mm., thickness approximately 2·0 mm.

Paratype from sample 33, Linden Bank.

Dimensions of paratype : Diameter 10·3 mm., thickness approximately 1·0 mm.

This form is very different from any previously described genus, and at first raised considerable doubts as to its foraminiferal nature. However, the structure of the test was found to be similar to that of *Botellina*, especially the large branching species *B. pinnata* Pearcey, with specimens of which it was compared. The differences are only in the plan of growth, which in the present form is circumferential with peripheral apertures, rather than axial with end apertures as in *Botellina*.

The two forms described above are found together in all the material in which the species occurs, and are clearly conspecific. It appears probable that as in other foraminifera they are the result of alternation of generations, but as their relation is not clear to the author, they have been deliberately recorded as Forms 1 and 2 to avoid possible false analogies with the " forma A, B " etc. of other authors in cases where the relationship has been well established.

The circular form is analogous to many other discoidal foraminifera, growing by the addition of concentric layers on the periphery of the test. Some of the smaller specimens expose the large sand-grains of the inner layer around the periphery, whereas in the larger specimens the outer fine-grained layers cover the periphery also, leaving small chinks through which pseudopodia presumably emerge.

The ellipsoidal form is similar in general structure and circumferential growth, but differs in having two regularly spaced holes passing through the test. The proportional spacing of these holes is the same for specimens of all sizes, suggesting migration of the holes in a radial direction during growth. This is supported by the radial slot-like form of the holes in the larger specimens, which may indicate breaking-down and re-sealing of the distal end of the hole at a rather faster rate than the building-up at the proximal end. In one small specimen the holes are represented by two dimples in either face, suggesting that the holes are not formed until a certain growth-stage is reached. The function of these holes is not at present apparent.

Specimens from the Barrier Reef material were found in samples 31, 33 and 47, in depths ranging from 16 to 37 fathoms. A series of specimens are in the author's possession from the collection of the late W. J. Parr, noted as having been collected by Mr. E. J. Riek from Moreton Bay, South Queensland in 4–6 fathoms. These specimens reached a maximum diameter of 2·3 cm., more than twice the size of Barrier Reef specimens, and were rather darker in colour and coarser in texture than the latter. They are, however, considered to be conspecific, and one of the large ellipsoidal Moreton Bay specimens has been selected as the holotype, with a circular Barrier Reef specimen as paratype.

Subfamily DENDROPHRYINAE.

Genus *Sagenina* Chapman, 1900.

(7) *Sagenina frondescens* (Brady).

Sagenella frondescens Brady (not *Sagenella* Hall), 1879, Quart. Journ. Micr. Sci. XIX, N.S., p. 41, pl. v, fig. 1; 1884, p. 278, pl. xxviii, figs. 14, 15.
Sagenina frondescens (Brady). Chapman, 1900, p. 4, pl. 1, figs. 1, 2; pl. 2, figs. 1, 2.

Occasional specimens attached to shell fragments were found in the samples of groups 1, 2 and 3.

(8) *Sagenina divaricans* Cushman.

Sagenina divaricans Cushman, 1910*a*, Proc. U.S. Nat. Mus. **38**, no. 1759, p. 437, text-fig. 1.

This species, distinguished from *S. frondescens* (Brady) by its smaller diameter and the neater construction of its tubular adherent test, was occasionally found on fragments of calcareous algae and molluscan shells in the samples of group 3.

Family SACCAMMINIDAE.

Subfamily PSAMMOSPHAERINAE.

Genus *Psammosphaera* Schulze, 1875.

(9) *Psammosphaera parva* Flint.

Psammosphaera parva Flint, 1899, Rep. U.S. Nat. Mus. for 1897, p. 268, pl. 9, fig. 1.

Frequent in sample 45, most specimens being built around one or more acicular sponge spicules.

(10) ? *Psammosphaera fusca testacea* Flint.

? *Psammosphaera fusca* Schulze, var. *testacea* Flint, 1899, Rep. U.S. Nat. Mus. for 1897, p. 268, pl. 8, fig. 2.

Four specimens from sample 45 appear to be referable to this subspecies. All are roughly hemispherical, corresponding to Flint's specimen " b ", noted as an " accidental section ". Apparently they have been attached, though if so the attachment must have been light, as the base of the tests consists of the rounded surfaces of the globigerine tests which form the wall, and there is no sign of cement. Nor do the tests appear to have been originally spherical and accidentally broken. Their generic position is somewhat doubtful.

Subfamily SACCAMMININAE.

Genus *Saccammina* M. Sars, 1869.

(11) *Saccammina consociata* Flint.

(Plate I, fig. 4.)

Saccamina consociata Flint, 1899, Rep. U.S. Nat. Mus. for 1897, p. 269, pl. 9, fig. 3.

Two specimens from sample 45, one free and one adherent to a pteropod shell, are referable to this species. Each consists of two chambers roughly constructed of sand-grains and joined by a stolon similarly constructed, with tubular projections both free and attached, the ends forming apertures. Flint's specimens were from deep water off Brazil.

Genus *Proteonina* Williamson, 1858.

(12) *Proteonina difflugiformis* (Brady).

Reophax difflugiformis Brady, 1879 etc., Quart. Journ. Micr. Sci. XIX, n.s., p. 51, pl. 4, figs. 3*a*, *b* ; 1884, p. 289, pl. xxx, figs. 2, 4 (not 1, 5).
Proteonina difflugiformis (Brady). Rhumbler, 1903, p. 245, text-figs. 80*a*, *b*.

Three specimens from sample 45 are armed with projecting sponge spicules as in Brady's fig. 4 (1884). A broken specimen shows that the wall is constructed of clear sand-grains, the spicules being cemented in interstices and not projecting inwards.

(13) *Proteonina cushmani* n. name.

Proteonina difflugiformis Brady, var. *lagenarium* Cushman (not *Haplophragmium lagenarium* Berthelin), 1910, U.S. Nat. Mus. Bull. **71**, p. 42, text-fig. 42.

Specimens are fairly common in sample 45. Bolli and Saunders (1954) have shown that Berthelin's " Lower Cretaceous " *Haplophragmium lagenarium* is almost certainly a recent species of the fresh-water Thecamoebid genus *Difflugia*, derived by contamination of the material by river water. They also suggest that the forms referred to this species by Cushman and McCulloch (1939), Parker (1952) and Parker, Phleger and Peirson (1953) are also Difflugiae. As these records are from brackish water or inshore localities, the suggestion is probably correct, but it cannot apply to the closely similar forms recorded by Cushman from depths of 299 and 2,175 fathoms in the North Pacific, nor to the present specimens from 600 metres. It is evidently a case of isomorphism between *Difflugia* and the marine foraminiferal genus *Proteonina*. Considering the simple unilocular type of test common to both genera, this appears to be the simplest and most likely explanation of the occurrence.

(14) *Proteonina micacea* Cushman.

Proteonina micacea Cushman, 1918 etc., U.S. Nat. Mus. Bull. **104**, p. 49, pl. xix, figs. 6, 7.

Six specimens of this small and delicate species were found in sample 45. The neck in each case was oblique to the axis of the test, apparently a consistent feature.

Genus *Thurammina* Brady, 1879.

(15) *Thurammina albicans* Brady.

Thurammina albicans Brady, 1879 etc., Quart, Journ. Micr. Sci. XIX, n.s., p. 46 ; 1884, p. 323, pl. xxxvii, figs. 2–7.

One specimen from sample 45, finely arenaceous and whitish in colour, with about 8 mammillate projections, appears to be referable to this species, although it is rather larger than as described by Brady, *ca.* 0·5 mm. in diameter.

Genus *Technitella* Norman, 1878.

(16) *Technitella legumen* Norman.

Technitella legumen Norman, 1878, Ann. Mag. Nat. Hist., ser. 5, **1**, p. 279, pl. 16, figs. 3, 4 ; Brady, 1884, p. 246, pl. xxv, figs. 8–12.

Two specimens were found in sample 45, one showing a collar-like aperture as in Brady's fig. 9. The species was recorded by Brady from off Sydney, N.S.W.

Subfamily WEBBINELLINAE.

Genus *Webbinella*, Rhumbler, 1903.

(17) *Webbinella hemisphaerica* (Jones, Parker and Brady).

Webbina hemisphaerica Jones, Parker and Brady (not *Webbina* d'Orbigny), 1866 etc., Monogr. Foram. Crag, p. 27, pl. iv, fig. 5.

Webbinella hemisphaerica (Jones, Parker and Brady). Rhumbler, 1903, p. 228, fig. 54.

Three specimens were found in sample 45 and three in sample 38, the latter a dredge station from which only coarse debris was received, all adherent to shell fragments.

Genus *Diffusilina* Heron-Allen and Earland, 1924.

(18) *Diffusilina humilis* Heron-Allen and Earland.

Diffusilina humilis Heron-Allen and Earland, 1924, Journ. Linn. Soc., Zool. **35**, p. 614, pl. 35, figs. 13–16.

One example from sample 38, agreeing with a specimen identified by Earland in the collection of the late W. J. Parr. This rarely-recorded species was described from Lord Howe Island, and is probably more common in Queensland waters than the present record would suggest, a comment which applies to other sessile foraminifera, in which the present collections are rather deficient.

Family INVOLUTINIDAE.

Subfamily INVOLUTININAE.

Genus *Involutina* Terquem, 1862.

(19) *Involutina* sp.

(Plate I, fig. 5.)

Ammodiscus incertus Parr (not *Operculina incerta* d'Orbigny) 1950, B.A.N.Z.A.R. Exped. Rept. V, pt. 6, p. 251.

Test finely arenaceous, planispiral, consisting of a clear chitinous proloculus and 12 whorls, periphery rounded, surface highly polished and reddish-brown in colour. One specimen from sample 45, 1·21 mm. in diameter.

The specimen is closely comparable with several specimens in the collection of the late W. J. Parr from the B.A.N.Z.A.R.E. dredgings off Tasmania. It is also very similar to a specimen sent to Parr by Dr. P. J. Bermudez, from off Cuba. Parr identified his specimens with d'Orbigny's " *Operculina* " *incerta*, then considered to be the type species of the genus *Ammodiscus* Reuss 1862. Loeblich and Tappan (1954) have since shown that *Ammodiscus* is a junior synonym of *Spirillina* Ehrenberg 1843, and that "*Operculina*" *incerta* is in fact a *Cornuspira*, leaving this arenaceous form un-named.

The species is apparently widely distributed in Recent seas, and is probably the "*Ammodiscus incertus*" of Brady and later authors. For this reason it is thought that any renaming should take into account material from a much wider range of localities than those from which specimens are available to the author, and the present specimen is therefore recorded by open nomenclature, and referred to the genus *Involutina*, stated by Loeblich and Tappan to be the next available name for species formerly included in the now invalid genus *Ammodiscus*.

Genus *Glomospira* Rzehak, 1888.

(20) *Glomospira charoides* (Jones and Parker).

Trochammina squamata charoides Jones and Parker, 1860, Quart. Journ. Geol. Sci. XVI, p. 304.
Glomospira charoides (Jones and Parker). Cushman, 1918, p. 100, pl. xxxvi, figs. 10–15.

Three typical specimens were found in sample 45.

(21) *Glomospira elongata* n. sp.

(Plate 1, figs. 6*a*, *b* ; 7*a*, *b*.)

Test finely arenaceous, smooth, coloured reddish-brown, consisting of a proloculus and a long undivided tubular chamber coiled in an elongated ellipse, the axis of coiling changing in successive whorls so as to form an approximately fusiform test ; later whorls added in one plane so that the fully developed test assumes a flattened elliptical form with a raised, elongate, elliptical central portion. Aperture formed by the open end of the tube.

Holotype from sample 45.

Dimensions of holotype : Major diameter 0·50 mm., thickness 0·11 mm.

This species differs from *G. gordialis* (Jones and Parker) in its elongate form and more regular growth-plan. It is common in sample 45 and is occasionally found in the samples of group 3.

Genus *Lituotuba* Rhumbler, 1895.

(22) *Lituotuba minuta* n. sp.

(Plate I, fig. 8).

Test minute, arenaceous, light reddish-brown in colour, proloculus indistinct, tubular chamber at first coiling in an irregular spiral and later uncoiling but irregular in direction, not constricted. Aperture formed by the open end of the tube.

Holotype from sample 42.

Dimensions of holotype : Diameter of coiled part 0·36 mm., total length 0·63 mm.

This species is distinguished from *L. lituiformis* (Brady) by its much smaller size and the absence of constrictions in the tubular test.

Genus *Tolypammina* Rhumbler, 1895.

(23) *Tolypammina vagans* (Brady).

Hyperammina vagans Brady, 1879, etc., Quart. Journ. Micr. Sci. XIX, n.s., p. 33, pl. v, fig. 3.
Tolypammina vagans (Brady). Cushman, 1910 etc., p. 67, text-figs. 84, 85 ; Earland, 1934, p. 96 ; Parr, 1950, p. 252.

One specimen, adherent to a large *Cibicides* test, was found in sample 45.

Genus *Ammolagena* Eimer and Fickert, 1899.

(24) *Ammolagena clavata* (Jones and Parker).

(Plate 1, fig. 9).

Trochammina irregularis clavata Jones and Parker, 1860, Quart. Journ. Geol. Sci. XVI, p. 304.
Ammolagena clavata (Jones and Parker). Eimer and Fickert, 1899, p. 673 ; Cushman, 1910 etc., p. 68, text-figs. 86–89 ; 1919, p. 597.

Five specimens were found in sample 45. Two exhibited nodosariform growth, a second pyriform chamber arising from the tubular extension of the first in a slightly curved axis as in *Dentalina.* As these specimens are otherwise indistinguishable from single-chambered specimens found in the same sample, it would appear that the definition of the genus should be amended to include the multilocular condition. Cushman has evidently made the same observation (1919) when he refers to " a double-chambered proloculum with the tubular portion broken away ".

Superfamily LITUOLIDEA.

Family Reophacidae.

Genus *Reophax* Montfort, 1808.

(25) *Reophax micaceus* Earland.

Reophax micaceus Earland, 1934, " Discovery " Repts., Cambridge, X, p. 82, pl. ii, figs. 37–40.

Five specimens of a slender and fragile form from sample 45 agree with Earland's description, particularly in regard to the wall structure, which consists of mica plates of varying sizes, with fine sand-grains used to build the apertural neck.

(26) *Reophax dentaliniformis* Brady.

Reophax dentaliniformis Brady, 1879 etc., (1881), Quart. Journ. Micr. Sci. XXI, n.s., p. 49 ; 1884, p. 293, pl. xxx, figs. 21, 22.

Seven specimens of 3 to 4 chambers each were found in sample 45.

(27) *Reophax scotti* Chaster.

Reophax scotti Chaster, 1892, Southport Soc. Nat. Sci. I, p. 57, pl. 1, fig. 1 ; Millett, 1898 etc. (1899), p. 255. pl. iv, fig. 13.

Occasional specimens were found in the samples of groups 1, 2 and 3, the majority being somewhat collapsed and flattened. One specimen from sample 1, consisting of 3 chambers only, was armed with sponge spicules built into the test parallel with the axis and projecting backwards over the suture to form a basal fringe. The species is apparently widely distributed in shallow water around the Australian coast, as similar specimens have been found by the author on tidal mud-flats in Port Phillip, Victoria.

(28) *Reophax* sp. cf. *catenatus* Höglund.

cf. *Reophax catenatus* Höglund, 1947, Zoolog. Bidr. Från Uppsala, **26**, p. 99, text-figs. 75, 76.

One specimen belonging to the *R. scotti* group was found with specimens of that species in sample 23. It differs from *R. scotti* in the shape of the chambers which are elongate and bullet-shaped, and in the character of the wall, which is composed of much smaller mica-plates, only just visible at a magnification of 120 ×. Unlike most specimens of *R. scotti*, it shows no tendency to collapse, though flexible in the wetted state. It is referred provisionally as above on account of the form of the chambers and the thin, finely constructed wall, though the chambers are rather smaller than in *R. catenatus* as described, 15 in a total length of 0·77 mm. as against 11 in a total length of 0·8 mm.

(29) *Reophax guttifer* Brady.

Reophax guttifera Brady, 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, n.s., p. 49 ; 1884, p. 295, pl. xxxi, figs. 10–15.
R. guttifer Brady. Cushman, 1910, p. 88, text-fig. 123 ; Parr, 1950, p. 266.

Four small but fairly characteristic specimens were found in sample 45. This species has a wide distribution in both hemispheres.

(30) *Reophax* sp. aff. *aduncus* Brady.

aff. *Reophax aduncus* Brady, 1882, Proc. Roy. Soc. Edinburgh, IX, p. 715 ; 1884, p. 296, pl. xxxi, figs. 23–26.

The specimens consist of a series of subglobular chambers, coarsely arenaceous with sponge spicules incorporated, irregularly uniserial with the chambers added at varying angles. The mode of growth is that of *R. aduncus*, but the tests are more irregular and coarsely-constructed than in the illustrations of that species. As no typical material is available for comparison, the identification is left open. Specimens are not uncommon in sample 45.

(31) *Reophax spiculifer* Brady.

Reophax spiculifera Brady, 1879 etc., Quart. Journ. Micr. Sci. XIX, n.s., p. 54, pl. 4, figs. 10, 11 ; 1884, p. 295, pl. xxxi, figs. 16, 17.
R. spiculifer Brady. Wiesner, 1931, p. 91, pl. ix, fig. 113 ; Parr, 1950, p. 269.

Three typical specimens were found in sample 45.

(32) *Reophax scorpiurus testaceus* Wiesner.

Reophax scorpiurus Montfort, var. *testacea* Wiesner, 1931, *in* Drygalski, Deutsche Sud Pol. Exped., 1901–03, **20**, p. 89, pl. viii, fig. 100 ; Parr, 1950, p. 269, pl. iv, fig. 19.

Specimens were not uncommon in sample 45. They resemble *R. scorpiurus scorpiurus* (which has not been found in this material) in size and general form, but differ in the consistent use of globigerine and other small foraminiferal tests instead of mineral grains in the construction of the wall. This feature does not appear to be fortuitous or conditioned by the availability of material, as other species of the genus present in the same sample use mineral grains exclusively.

(33) *Reophax agglutinatus* Cushman.

Reophax agglutinatus Cushman, 1921, U.S. Nat. Mus. Bull. **100**, p. 73, pl. 14, figs. 2a, *b*.

Large roughly-constructed specimens up to 3 mm. in length, using small Amphisteginae and Operculinae in the construction of the wall, are referred to this species. This is a very much larger form than *R. scorpiurus*, to which such specimens have been referred. In the present material it is characteristic of the shallow-water dredgings of group 3, *R. scorpiurus testacea* occurring only in the deeper-water sample 45.

Family LITUOLIDAE.

Subfamily HAPLOPHRAGMINAE.

Genus *Haplophragmoides* Cushman, 1910.

(34) *Haplophragmoides canariensis* (d'Orbigny).

Nonionina canariense d'Orbigny, 1839, Foram. Canaries, p. 128, pl. 11, figs. 33, 34.
Haplophragmium canariense (d'Orbigny). Brady, 1884, p. 310, pl. xxxv, figs. 1–5 ; Millett, 1898 etc. (1899), p. 359 ; Heron-Allen and Earland, 1914 etc. (1915), p. 614.
Haplophragmoides canariensis (d'Orbigny). Cushman, 1910, p. 101, fig. 144.

Five good specimens were found in sample 45. This is a wide-ranging form which has been recorded from various localities in the Indo-Pacific region.

Genus *Cribrostomoides* Cushman, 1910.

(35) *Cribrostomoides* sp. aff. *wiesneri* (Parr).

aff. *Labrospira wiesneri* Parr, 1950, B.A.N.Z.A.R. Exped. Rep. V, part 6, p. 272, pl. iv, figs. 25, 26.

One specimen from sample 45 is close to Parr's species but rather more compressed and red-brown in colour. The interioareal aperture of this species places it in the genus *Cribrostomoides* Cushman, which, as shown by Frizzell and Schwartz (1950), takes precedence over *Labrospira* Höglund, 1947.

Genus *Ammobaculites* Cushman, 1910.

(36) *Ammobaculites reophaciformis* Cushman.

Ammobaculites reophaciformis Cushman, 1910, Proc. U.S. Nat. Mus. **38**, no. 1759, p. 440, text-figs. 12, 13, 14 ; Chapman and Parr, 1935, p. 5, pl. 1, figs. 5, 6.

Three typical specimens were found in sample 45. The species was described from the Philippines and is recorded from the Great Australian Bight by Chapman and Parr.

(37) *Ammobaculites agglutinans* (d'Orbigny).

Spirolina agglutinans d'Orbigny, 1846, For. foss. Vienne, p. 137, pl. 7, figs. 10–12.
Ammobaculites agglutinans (d'Orbigny). Cushman, 1910, p. 115, text-fig. 176.

Two typical specimens were found in sample 45 and one in sample 23.

(38) *Ammobaculites americanus* Cushman.

Haplophragmium fontinense Brady (not of Terquem), 1884, p. 305, pl. xxxiv, figs. 1–4.
Ammobaculites americanus Cushman, 1910, U.S. Nat. Mus. Bull. **71**, p. 117, text-figs. 184, 185.

Six specimens from sample 45 appear to be referable to this species, hitherto known only from the Atlantic and Pacific coasts of America. They are considerably smaller than those recorded by Cushman, the largest being *ca.* 1·1 mm. in length, but compare well with the smaller specimens figured by Brady as *H. fontinense.*

Genus *Ammomarginulina* Wiesner, 1931.

(39) *Ammomarginulina ensis* Wiesner.

Ammomarginulina ensis Wiesner, 1931, *in* Drygalski, Deutsche Sud Pol. Exped. **20**, p. 97, pl. xii, fig. 147; Earland, 1933, p. 82, pl. iii, figs. 1–4 ; Parr, 1950, p. 273.

This species was described from the Antarctic. Parr (loc. cit.) records specimens from Tasmanian and Victorian waters, and mentions specimens sent to him by Earland from the Barrier Reef. Apparently it has a wide range in the Australian region and the Southern Ocean. Five specimens were found in sample 45.

(40) *Ammomarginulina australiensis* n. sp.

(Plate I, figs. 10*a*, *b*.)

Test arenaceous, built up of sand-grains cemented with a whitish cement, early chambers planispiral and compressed, somewhat involute, with a depressed umbilicus ; later chambers marginuline tending towards uniseriality, periphery rounded, aperture slit-like and distal. The majority of specimens have no more than one uniserial chamber. Chamber divisions correspond with the external sutures and are thin cemented-sand structures, not chitinous.

Holotype from sample 9.

Dimensions of holotype : Length 0·90 mm., breadth 0·40 mm., thickness 0·20 mm.

This species is similar in outline to *Ammobaculites salsus* Cushman and Bronnimann, but is compressed throughout its growth. It is frequent in the samples of groups 2 and 3 and common in the mangrove-pool samples of group 1. Similar specimens have been found by the author on tidal mud-flats in Corio Bay, Victoria. Both habitats suggest considerable tolerance of variation in temperature and salinity, the Victorian record being from shallow land-locked waters where rainfall and summer heat can vary conditions considerably.

Genus *Placopsilina* d'Orbigny, 1850.

(41) *Placopsilina bradyi* Cushman and McCulloch.

Placopsilina cenomana Brady (not of d'Orbigny), 1884, p. 315, pl. xxxvi, figs. 1–3.
P. bradyi Cushman and McCulloch, 1939. Allen Hancock Pacific Exped. **6**, no. 1, p. 112, pl. 12, figs. 14, 15.

Typical specimens were not uncommon in the samples of group 3, wherever bottom conditions were such as to favour the growth of sessile forms.

Genus *Nouria* Heron-Allen and Earland, 1914.

(42) *Nouria polymorphinoides* Heron-Allen and Earland.

Nouria polymorphinoides Heron-Allen and Earland, 1914, Trans. Zool. Soc. London, **20**, p. 376, pl. 37, figs. 1–15.

Specimens are elongate and built of large flaky calcareous fragments, but appear to fall within the limits of variation of this species. Not uncommon in samples of group 3.

(43) *Nouria tenuis* Hada.

Nouria tenuis Hada, 1931, Sci. Rep. Tohuku Imp. Univ., ser. 4, **6**, no. 1, p. 94, text-fig. 46.

Two specimens close to Hada's figure were found in sample 23, the largest 1·1 mm. in length. The species is easily distinguished from others of the genus by its extreme compression and sharp-edged periphery.

(44) *Nouria textulariformis* Hada, *armata* n. subsp.

(Plate I, figs. 11*a*, *b*.)

The characteristics are generally those of the species s. str., but include also the use of sponge spicules built into the test and projecting at the periphery, directed backward from the aperture. This is a constant feature of the Barrier Reef specimens and appears to warrant some distinction.

Holotype from sample 23.

Dimensions of holotype : Length 0·90 mm., breadth 0·62 mm., thickness *ca.* 0·15 mm.

Occasional in the samples of group 3.

Subfamily LITUOLINAE.

Genus *Haddonia* Chapman, 1898.

(45) *Haddonia minor* Chapman.

Haddonia minor Chapman, 1901, Journ. Linn. Soc. London, **28**, p. 384, pl. 36, figs. 1, 2.

Chapman's description and figures of this species could be clearer. Apparently it differs from *H. torresiensis* Chapman in its much smaller size and simple aperture. One specimen from sample 29, 4 mm. in length and having the general characteristics of *Haddonia* in free growth and low, flattened chambers is referred to this species. The apertural end is unfortunately broken.

Family TEXTULARIIDAE.

Genus *Textularia* Defrance, 1824.

(46) *Textularia fistulosa* Brady.

Textularia sagittula Defrance, var. *fistulosa* Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 362, pl. xlii, figs. 19–22.

Six specimens from sample 45 are referable to Brady's variety, though the fistulose projections are more strongly developed. The presence of these tubular extensions of the chamber wall is a major feature of the morphology of this form, and appears to justify specific distinction.

(47) *Textularia candeiana* d'Orbigny.

Textularia candeiana d'Orbigny, 1839, *in* de la Sagra, Hist. phys. pol. nat. Cuba, " Foraminifères ", p. 143, pl. 1, figs. 25–27.

This species is widely distributed in the tropics but is not well represented in the Barrier Reef material, a few specimens only being found in the samples of group 3.

(48) *Textularia vola* Lalicker and McCulloch.

Textularia vola Lalicker and McCulloch, 1940, Allen Hancock Pacific Exped. **6**, no. 2, p. 142, pl. 16, figs. 27*a–c*.

Four typical examples of this species were found in sample 45. It was described from the Galapagos Islands.

(49) *Textularia orbica* Lalicker and McCulloch.

Textularia trochus Brady (not of d'Orbigny), 1884, p. 366, pl. xciii, figs. 15, 16, and 18.
T. orbica Lalicker and McCulloch, 1940, Allen Hancock Pacific Exped. **6**, no. 2, p. 136, pl. 15, figs. 17*a*, *b*, *c*.

This is one of the commonest textularians in the shallow-water samples of groups 1, 2 and 3. It is widely distributed in the Pacific.

(50) *Textularia kerimbaensis* Said.

Textularia conica d'Orbigny, var. *corrugata* Heron-Allen and Earland (not *T. corrugata* Costa), 1914, etc. (1915), Trans. Zool. Soc. London, **20**, p. 629, pl. 47, figs. 24–27.
T. corrugata Cushman (not of Costa), 1932 etc. (1932), p. 12, pl. 3, figs. 2, 4 ; Lalicker and McCulloch, 1940, p. 126, pl. 14, figs. 9*a–d*.
T. kerimbaensis Said, 1949, p. 6, pl. 1, fig. 8.

Specimens show the downward curve of the sutures at the periphery and the inflation of the upper part of the later chambers, characteristic of this species. It is common in the samples of groups 1, 2 and 3.

(51) *Textularia foliacea* Heron-Allen and Earland.

Textularia foliacea Heron-Allen and Earland, 1914 etc. (1915), Trans. Zool. Soc. London, **20**, p. 628, pl. 47, figs. 17–20.

Common in the samples of groups 1, 2 and 3.

(52) *Textularia porrecta* Brady.

Textularia agglutinans d'Orbigny, var. *porrecta* Brady, 1884, Rep. Voy. Chall,. Zool **9**, p. 363, pl. xliii, fig. 4.
T. porrecta Brady. Egger, 1893, p. 269, pl. iv, figs. 17, 18 ; Heron-Allen and Earland, 1914 etc. (1915), p. 627.

Occasional specimens in the samples of groups 1, 2 and 3, not common.

(53) *Textularia conica* d'Orbigny.

Textularia conica d'Orbigny, 1839, *in* de la Sagra, Hist. phys. pol. nat. Cuba, "Foraminifères," p. 143, pl. 1, figs., 19, 20 ; Heron-Allen and Earland, 1914, etc. (1915), p. 629 ; Lalicker and McCulloch, 1940, p. 126, pl. 14, figs. 8*a*, *b*, *c*.

This widely-distributed species is represented by occasional specimens in the samples of groups 1, 2 and 3.

(54) *Textularia vertebralis* Cushman.

Textularia vertebralis Cushman, 1913, Proc. U.S. Nat. Mus. **44**, no. 1973, p. 633, pl. 78, fig. 1 ; Parr, 1950, p. 274, pl. iv, fig. 29.

Well-developed specimens were found in sample 29. As in Parr's specimens from off Tasmania, the concave projection of the lower part of the chamber is poorly developed in the earlier part of the test, though typical in the latter two-thirds.

Family TROCHAMMINIDAE.

Genus *Trochammina* Parker and Jones, 1859.

(55) *Trochammina globigeriniformis* (Parker and Jones).

Lituola nautiloidea, var. *globigeriniformis* Parker and Jones, 1865, Trans. Roy. Soc. London, **155**, p. 407, pl. 15, figs. 46, 47.

Trochammina globigeriniformis (Parker and Jones). Cushman, 1910 etc. (1910), p. 124, text-figs. 193–195 (synonymy).

Seven small specimens were found in sample 45. The species has a general distribution in deep water.

(56) *Trochammina rotaliformis* J. Wright.

Trochammina rotaliformis J. Wright, 1911, *in* Heron-Allen and Earland, Journ. Roy. Micr. Soc. for 1911, p. 309 ; Heron-Allen and Earland, 1914 etc. (1915), p. 620.

Specimens are frequent in the samples of group 3, occasional in those of groups 1 and 2.

(57) *Trochammina chitinosa* n. sp.

(Plate I, figs. 12*a*, *b*, *c*.)

? *Trochammina ochracea* (Williamson), var., Heron-Allen and Earland, 1914 etc. (1915), p. 619, pl. xlvi, figs. 27, 28.

Test subcircular in outline, thin, dorsal side convex, early chamber walls brown and chitinous with scattered sand-grains imbedded, later chambers whitish and sandy on a chitinous base, sutures slightly depressed and irregularly recurved. Ventral side slightly concave with depressed umbilicus, chamber walls chitinous, clear and brown, sutures strongly recurved, limbate, consisting of whitish cement and ending in a bulb short of the umbilicus. Periphery sharp with a thin chitinous keel, aperture obscure.

Holotype from sample 1.

Dimensions of holotype : Diameter 0·37 mm., thickness 0·08 mm.

This species differs from *T. ochracea* (Williamson) in its much less regular form, fewer chambers to the whorl, greater size and more convex form. It is apparently the form described by Heron-Allen and Earland (loc. cit.) as a variety of *T. ochracea*. Specimens were rare in the samples of groups 1, 2 and 3.

Genus *Remaneica* Rhumbler, 1938.

(58) *Remaneica* sp. aff. *plicata* (Terquem).

aff. *Patellina plicata* Terquem, 1875 etc. (1876), Essai Class. Anim. Dunkerque, **2**, p. 72, pl. viii, fig. 9.

Trochammina plicata (Terquem). Balkwill and Millett, 1884, p. 26, pl. ii, fig. 8 ; Millett, 1898 etc. (1899), p. 363, pl. v, fig. 13 ; Heron-Allen and Earland, 1914 etc. (1915), p. 619.

Five specimens were found in sample 45. The plications of the ventral side are fine and regular as noted by Heron-Allen and Earland in connection with their Kerimba specimens, and the Pacific form may be distinct from Terquem's species.

Genus *Carterina* Brady, 1884.

(59) *Carterina spiculotesta* (Carter).

Rotalia spiculotesta Carter, 1877, Ann. Mag. Nat. Hist., ser 4, **20**, p. 470, pl. 16.

Carterina spiculotesta (Carter). Brady, 1884, p. 346, pl. 41, figs. 7–10.

Typical specimens were rare in the samples of groups 3 and 4. All were rotaliform, the largest reaching a diameter of 1·75 mm., and no specimens of the " amoeboid " irregular form figured by Carter were found.

Genus *Ammosphaeroidina* Cushman, 1910.

(60) *Ammosphaeroidina sphaeroidiniformis* (Brady).

Haplophragmium sphaeroidiniforme Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 313.
Ammosphaeroidina sphaeroidiniformis (Brady). Cushman, 1910 etc. (1910), U.S. Nat. Mus. Bull. **71**, p. 128, text-fig. 202 ; Parr, 1950, p. 281, pl. v, fig. 21.

Two specimens of this widely-distributed species are recorded from sample 45.

Family VERNEUILINIDAE.

Subfamily VERNEUILININAE

Genus *Gaudryina* d'Orbigny, 1839.

Subgenus *Siphogaudryina* Cushman, 1935.

(61) *Gaudryina* (*Siphogaudryina*) *rugulosa* Cushman.

Gaudryina rugulosa Cushman, 1932 etc. (1932), U.S. Nat. Mus. Bull. **161**, pt. 1, p. 15, pl. 4, figs. 1*a*, *b*.

Typical examples were found in group 3 samples from offshore localities, particularly no. 30.

(62) *Gaudryina* (*Siphogaudryina*) sp. cf. *wrightiana* Millett.

(Plate I, figs. 13*a*, *b*, *c*.)

Gaudryina Wrightiana Millet, Journ. Roy. Micr. Soc., 1900, p. 10, pl. 1, figs. 11 and 12.

One small specimen from sample 29 is referred to this species with some doubt. The general form agrees with Millett's description, but the angles of the test are fistulose, the broken ends showing as rounded cavities. Neither Millett's figures nor his description indicate any such structure, but it is one of the characters of the subgenus, to which the species is referred on other evidence (Cushman, 1937, p. 82). It is possible that Millett's specimens were better preserved and did not show this fistulose structure.

(63) *Gaudryina* (*Siphogaudryina*) *siphonifera* (Brady).

Textularia siphonifera Brady, 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, N.S., p. 53 ; 1884, p. 362, pl. xlii, figs. 25–29.
Gaudryina siphonifera (Brady). Cushman, 1928, p. 109, pl. 16, figs. 1–5.
G. (*Siphogaudryina*) *siphonifera* (Brady). Cushman, 1937, p. 83, pl. 12, figs. 9, 10.

One well-developed specimen was found in sample 30. It has a general Indo-Pacific distribution.

Subgenus *Pseudogaudryina* Cushman, 1936.

(64) *Gaudryina* (*Pseudogaudryina*) *concava*, n. sp.

(Plate I, figs. 14*a*, *b*, *c*.)

Test finely arenaceous, triangular in section throughout, with slightly concave faces and sharp, somewhat serrate edges, chambers not inflated, sutures indistinct, later chambers developing an overhanging margin giving the appearance of excavation in the lower part of the chamber ; aperture a slit in a shallow re-entrant in the middle of the inner margin of the last chamber.

Holotype from sample 45, in which the species is rare.

Dimensions of holotype : Length 0·93 mm., width 0·64 mm.

This species differs from *G.* (*Ps.*) *jarvisi* Cushman from the Miocene of Buff Bay, Jamaica, in its more roughly-constructed test and in the overlapping of the later chambers. It does not appear to closely resemble any Recent species.

Genus *Pseudoclavulina* Cushman, 1936.

(65) *Pseudoclavulina juncea* Cushman.

Pseudoclavulina juncea Cushman, 1936, Sp. Publ. No. 6, Cushman Lab. Foram. Res., p. 19, pl. 3, figs. 8*a*, *b*.

This elongate and slender form is referred to Cushman's species which was described from the Phillippines, though the aperture differs to some extent, being crescentic as in some other species of the genus, rather than rounded. Two specimens were found in sample 45.

(66) *Pseudoclavulina scabra* Cushman.

Pseudoclavulina scabra Cushman, 1936, Sp. Publ. No. 6, Cushman Lab. Foram. Res., p. 20, pl. 3, figs. 11*a*, *b*.

Three short, stout specimens with low uniserial chambers, from sample 45, are referred to this species, which was described from the Phillippines. The aperture is terminal and rounded, differing in this respect from *P. juncea*, found in the same sample.

Subfamily EGGERELLINAE.

Genus *Eggerella* Cushman, 1933.

(67) *Eggerella australis* n. sp.

(Plate II, figs. 1*a*, *b*.)

Test minute, rather coarsely arenaceous, conical, early chambers obscure, apparently trochospiral, later chambers triserial, inflated, aperture loop-shaped, at the interior margin of the last chamber.

Holotype from sample 24.

Dimensions of holotype : Length 0·29 mm., greatest diameter 0·19 mm.

This small species is fairly common in the finer fractions of the samples of group 3. Similar specimens in the collection of the late W. J. Parr were from off Gabo Island, at the east end of Bass Strait. It differs from *E. subconica* Parr, described from off Tasmania, in its coarser construction, more tapering form and invariably triserial arrangement of the final chambers.

(68) *Eggerella polita* n. sp.

(Plate II, figs. 2*a*, *b*.)

Test finely arenaceous, smoothly finished and shining, reddish-brown in early chambers, white in the last one or two ; subconical with bluntly pointed initial end, oral end broadly lobed by the last three chambers. Chambers slightly inflated with depressed sutures, arranged in a trochoid spiral of 4 to 5 whorls, earlier chambers 4 to the whorl, later chambers triserial. Aperture a minute hole near the base of the apertural face of the last chamber.

Holotype from sample 45, where it is not uncommon.

Dimensions of holotype : Length 0·37 mm., greatest diameter 0·25 mm.

This species is perhaps closest to *E. scabra* (Williamson), but in comparison with specimens of the latter species from the British coast it differs in its finer and smoother construction, less inflated chambers, minute aperture and much smaller size.

Grnus *Dorothia* Plummer, 1931.

(69) *Dorothia arenata* Cushman.

Dorothia arenata Cushman, 1936, Sp. Publ. No. 6, Cushman Lab. Foram. Research, p. 32, pl. 5, figs. 11*a*.*c*

Fine examples of this species were common in sample 45.

(70) *Dorothia inepta* n. sp.

(Plate II, figs. 3 and 4.)

Test arenaceous, early chambers subconical and trochospiral with 4 or 5 chambers to the whorl, later chambers biserial, finally becoming irregular in form, roughly biserial but modified by attachment to other bodies. Aperture either an arched slit at the inner margin of the last-formed chamber or a rounded opening in the septal face, apparently depending upon the conditions of attachment. Some specimens are regularly biserial and show their relationship by the flattened and irregular shape of the final chambers, others become wild-growing and change the axis of growth by as much as 45°, or twist in varions directions.

Holotype from sample 30.

Dimensions of holotype : Length 1·6 mm., greatest width 0·7 mm.

This species shows a parallel development to that of the genus *Rudigaudryina* Lalicker and McCulloch, but has apparently evolved from a regular species of *Dorothia* rather than from *Gaudryina*. It is fairly common in the samples of group 3. This is apparently the form occurring at Lord Howe Island, referred by Heron-Allen and Earland to *Haddonia torresiensis* Chapman (Journ. Linn. Soc., Zool. **35**, 1924, pl. 35, figs. 17–20, 22–32, not 21). The growth habit of *Haddonia* is the reverse of that of this species, being attached in the early stages and free in the later chambers, whereas *D. inepta* is apparently attached by successive oral faces throughout life. Evidence of this attachment in most cases rests in the variable and frequently concave shape of the apertural faces of the final chambers, appearing to be the reverse mould of variously rounded and flattened surfaces. The holotype, however, is attached to a shell fragment which has apparently broken away with the test, the last chamber of which partially envelops it. Probably the species is attached in life by extruded protoplasm to a surface, the contours of which are closely followed by the chamber wall as it is formed.

Genus *Karreriella* Cushman, 1933.

Subgenus *Karrerulina* Finlay, 1940.

(71) *Karriella* (*Karrerulina*) *apicularis* (Cushman).

Gaudryina siphonella Brady, 1884 (not of Reuss), 9, p. 382, pl. xlvi, figs. 17–19.
G. apicularis Cushman, 1910 etc. (1911), U.S. Nat. Mus. Bull. 71, pt. 2, p. 69, text-figs. 110*a*, *b*.
Plectina apicularis Cushman, 1937, p. 110, pl. 12, figs. 22–26.
Karreriella (*Karrerulina*) *apicularis* (Cushman). Finlay, 1939 etc., (1940), 69, pt. 4, p. 450.

Nine specimens of this well-known form were found in sample 45.

(72) *Karreriella* (*Karrerulina*) *attenuata* n. sp.

(Plate II, fig. 5.)

Test arenaceous, slender, tapering, commencing with a short trochospiral series with 5 chambers to the whorl, then becoming biserial with up to 9 pairs of chambers, sutures depressed, chambers somewhat inflated and increasing in size, last chamber pyriform with terminal spout-like aperture. Occasional large sand-grains are built into the wall of the test.

Holotype from sample 45.

Dimensions of holotype : Length 0·46 mm., breadth 0·14 mm., thickness 0·10 mm.

This small species is characterized by the very abbreviated initial series of chambers, the long biserial portion and the regular taper of the test. Apart from the apertural characters it closely resembles *Textularia tenuissima* Earland, but does not seem to be close to any described species of its genus.

Subfamily VALVULININAE.

Genus *Valvulina* d'Orbigny, 1826.

(73) *Valvulina conica* Parker and Jones.

Valvulina triangularis d'Orbigny,var. *conica* Parker and Jones, 1865, Phil. Trans. **155**, p. 406, pl. 15, fig. 27.
V. conica Parker and Jones. Brady, 1884, p. 392, pl. xlix, figs. 15, 16.

Not uncommon in sample 45, some specimens being adherent to shell fragments.

Genus *Clavulina* d'Orbigny, 1826.

(74) *Clavulina multicamerata* Chapman.

Clavulina parisiensis d'Orbigny, var. *multicamerata* Chapman, 1909, Journ. Quekett Micr. Club, ser. 2, **10**, p. 127, pl. 9, fig. 5.
C. multicamerata Chapman. Cushman, 1937*a*, p. 24, pl. 3, figs. 13–16.

Common in most of the samples of groups 1, 2 and 3. This species, described from Shoreham, Victoria, evidently has a wide Indo-Pacific range, as the author has collected typical specimens from shallow water near Dar-es-Salaam, Tanganyika Territory.

(75) *Clavulina pacifica* Cushman.

Clavulina pacifica Cushman, 1924, Publ. 342, Carnegie Inst. Washington, p. 22, pl. 6, figs. 7–11.

Occurs generally in the same groups as *C. multicamerata* but is not so common as that species.

Superfamily MILIOLIDEA.

Family MILIOLIDAE.

Genus *Quinqueloculina* d'Orbigny, 1826.

(76) *Quinqueloculina anguina arenata* Said.

Miliolina anguina Terquem, var. *agglutinans* Wiesner, 1915 (not *Quinqueloculina agglutinans* d'Orbigny), *in* Heron-Allen and Earland, Trans. Zool. Soc. London, XX, pt. 2, p. 575.
Quinqueloculina anguina (Terquem), var. *arenata* Said, 1949, Sp. Publ. No. 26, Cushman Lab. Foram. Research, p. 9, pl. 1, fig. 25.
Q. anguina (Terquem) var. *wiesneri* Parr, 1950, p. 290, pl. vi, figs. 9, 10.

This species, which is recorded from Indo-Pacific localities ranging from the Red Sea to the Pacific Islands, and from as far south as Tasmania, is fairly common in the samples of group 3. Owing to the delay in publication of his Antarctic monograph, Parr's new name for this form was antedated by that of Said, which therefore takes precedence.

(77) *Quinqueloculina berthelotiana* d'Orbigny.

Quinqueloculina berthelotiana d'Orbigny, 1839, *in* Barker-Webb and Berthelot, Hist. Nat. Iles Canaries, 2, pt. 2, "Foraminifères," p. 142, pl. 3, figs. 25–27; Cushman, 1932 etc., p. 19, pl. 5, figs. 2–4.

Specimens with produced neck, rounded aperture and the chambers irregularly keeled and sinuous are referred to this species, recorded by Cushman from the tropical Pacific. Occasional specimens were found in the samples of groups 1, 2 and 3.

(78) *Quinqueloculina bicarinata* d'Orbigny.

Quinqueloculina bicarinata d'Orbigny, 1826, Ann. Sci. Nat., p. 302, no. 35; Cushman, 1921, p. 428, pl. 86, figs. 2, 3; pl. 100, fig. 7.

Occasional specimens of this double-keeled form were found in some of the samples of groups 1, 2 and 3.

(79) *Quinqueloculina bidentata* d'Orbigny.

Quinqueloculina bidentata d'Orbigny, 1839, *in* de la Sagra, Hist. phys. pol. nat. Cuba, "Foraminifères", p. 197, pl. 12, figs. 18–20; Cushman, 1932 etc., p. 20, pl. 5, fig. 5.

This large coarsely-built arenaceous species with truncate periphery occurs sparsely in the samples of groups 1, 2 and 3. It was recorded from the tropical Pacific by Cushman.

(80) *Quinqueloculina crassicarinata* n. sp.

(Plate II, 7 figs. 6*a*, *b*, *c*.)

Test porcellaneous, smooth, quinqueloculine, subcircular in frontal view, chambers wedge-shaped in section with a strong square-edged keel, somewhat sinuate in outline. Aperture oval with a flared lip and small simple tooth, produced on a short neck.

Holotype from sample 34.

Dimensions of holotype: Length 0·81 mm., breadth 0·69 mm., thickness 0·49 mm.

This species is distinguished from *Q. lamarckiana* d'Orbigny by its produced neck and the square-edged keel. It is not uncommon in the samples of groups 1, 2 and 3.

(81) *Quinqueloculina crenulata* Cushman.

Quinqueloculina crenulata Cushman, 1932 etc., U.S. Nat. Mus. Bull. **161**, p. 21, pl. 5, figs. 11*a*–*c*.

This slender and elegant species was described from the Caroline Islands, and evidently has a fairly wide Pacific range. It occurs in small numbers in many of the samples of groups 1, 2 and 3.

(82) *Quinqueloculina cuvieriana* d'Orbigny, *queenslandica*, n. subsp.

(Plate II, figs. 7*a*, *b*, *c*.)

Test porcellaneous, smooth, polished, subcircular in outline, quinqueloculine, periphery truncate or rounded with 2 or 3 low costae, aperture large, loop-shaped with a short bifurcate tooth.

Holotype from sample 7.

Dimensions of holotype : Length 0·50 mm., breadth 0·44 mm., thickness 0·29 mm.

This subspecies varies from *Q. cuvieriana cuvieriana,* which has not been found in these samples, in its bluntly-rounded or truncate periphery, more rounded aperture, shorter tooth and somewhat more inflated chambers. A few specimens were found in many of the samples of groups 1, 2 and 3.

(83) *Quinqueloculina quinquecarinata* n. sp.

(Plate II, figs. 8*a*, *b*, *c*.)

Test minute, quinqueloculine, elongate, chambers wedge-shaped with sharp keel, chamber wall translucent, keel opaque and white, apertural end produced as a short neck with a slightly flaring lip, aperture rounded with a small simple tooth.

Holotype from sample 34.

Dimensions of holotype : Length 0·47 mm., breadth 0·18 mm., thickness 0·13 mm.

This small species is found in most of the samples of group 3 and in the finer fractions, where present, of groups 1 and 2. It bears some resemblance to *Q. ferussacii* d'Orbigny, but lacks the strong lateral costae which are developed on the later chambers of that species.

(84) *Quinqueloculiana lamarckiana* d'Orbigny.

Quinqueloculina lamarckiana d'Orbigny, 1839, *in* de la Sagra, Hist. phys. pol. nat. Cuba, " Foraminifères ", p. 189, pl. 11, figs. 14, 15.

This widely distributed species was found occasionally in the samples of groups 1, 2 and 3.

(85) *Quinqueloculina milletti* (Wiesner).

Miliolina bosciana Millett, 1898 (not *Quinqueloculina bosciana* d'Orbigny), Journ. Roy. Micr. Soc., 1898 etc., p. 267, pl. vi, fig. 1.
M. milletti Wiesner, 1912, Arch. Prot. **25**, p. 220.

This small, smooth-surfaced and elongate species was common in the finer fractions of most of the samples of groups 1, 2 and 3, and was particularly characteristic of the mangrove-pool habitat of group 1.

(86) *Quinqueloculina neostriatula* Thalmann.

Quinqueloculina striatula Cushman, 1932 etc. (not of Deshayes), p. 27, pl. 7, figs. 3, 4.
Q. neostriatula Thalmann, 1950, Contr. Cushman. Found. Foram. Foram. Research, 1, pts. 3 and 4, p. 45.

The broad crescentic aperture and narrow lip of this finely-striate species is distinctive. It was common in many of the samples of groups 1, 2 and 3.

(87) *Quinqueloculina polygona* d'Orbigny.

Quinqueloculina polygona d'Orbigny, 1839, *in* de la Sagra, Hist. phys. pol. nat. Cuba, " Foraminifères ", p. 198, pl. 12, figs. 21, 23.

This species, which was common in the samples of groups 1, 2 and 3, is quite distinct from the cool-water form figured by Parr (1945) as *Q. subpolygona,* being more elongate, with the keels sharp-edged and regularly curved.

(88) *Quinqueloculina pseudoreticulata* Parr.

Miliolina reticulata Brady, 1884 (not *Triloculina reticulata* d'Orbigny), p. 177, pl. ix, figs. 2, 3 (not fig. 4).
Quinqueloculina pseudoreticulata Parr, 1941, p. 305.

This common large Barrier Reef species was found in most of the samples of groups 1, 2 and 3.

(89) *Quinqueloculina samoaensis* Cushman.

Quinqueloculina samoaensis Cushman, 1924, Publ. No. 342, Carnegie Inst. Washington, p. 59, pl. 21, figs. 4–7 ; 1932 etc., p. 26, pl. 7, figs. 1*a–c*.

Rare in the samples of group 3. Its squarish periphery. produced neck and encrustation of sand-grains are distinctive.

(90) *Quinqueloculina semireticulosa* Cushman.

Quinqueloculina semireticulosa Cushman, 1932 etc., U.S. Nat. Mus. Bull. **161**, pt. 1, p. 27, pl. 7, figs. 2*a*, *b*.

Two specimens from sample 44 agree with Cushman's figure and description in the character of the ornament and in the small oval aperture separated from the sutural margin of the last chamber.

(91) *Quinqueloculina sulcata* d'Orbigny.

Quinqueloculina sulcata d'Orbigny, 1826, Ann. Sci. Nat. **7**, p. 301, no. 17 ; Fornasini, 1900, p. 363, text-fig. 9 ; Cushman, 1932 etc., p. 28, pl. 7, figs. 5–8.

This large striking species was described from the Red Sea and is recorded from the Pacific Islands. It is common in many of the samples of groups 1, 2 and 3.

(92) *Quinqueloculina tropicalis* Cushman.

Miliolina gracilis Brady, 1884 (not *Triloculina gracilis* d'Orbigny), p. 160, pl. v, figs. 2*a–c*.
Quinqueloculina tropicalis Cushman, 1924, Publ. 342, Carnegie Inst. Washington, p. 63, pl. 23, figs. 9, 10.

Rare in the shallow-water samples, one specimen each from samples 1 and 44.

(93) *Quinqueloculina rugosa* d'Orbigny.

Quinqueloculina rugosa d'Orbigny, 1826, Ann. Sci. Nat. **7**, p. 302, No. 24 ; Cushman, 1910 etc. (1917), p. 53.

This species, with truncate and inflated periphery and rough pitted surface, is rare in samples of group 3.

Genus *Massilina* Schlumberger, 1893.

(94) *Massilina subrugosa* n. sp.

(Plate II, fig. 9.)

Massilina secans d'Orbigny, var. *rugosa* Heron-Allen and Earland (not *Massilina rugosa* Sidebottom), 1914 etc. (1915), Trans. Zool. Soc. London, XX, pt. 17, p. 583, pl. xlv, figs. 5–12.

This species is common in many of the shallow-water samples of groups 2 and 3. The test is heavily built, porcellaneous and coated with a thin layer of sand-grains except near the aperture, where the smooth white shell wall appears. The form of the test is somewhat variable, the periphery varying from bluntly carinate to truncate. Heron-Allen and Earland's varietal name *rugosa* is a homonym of *M. rugosa* Sidebottom, 1904. There is little resemblance between this form and the compressed and laterally expanded *M. secans,* so that it is here raised to specific rank under the name *subrugosa.*

(95) *Massilina secans* d'Orbigny, *tropicalis* n. subsp.

(Plate II, figs. 10*a, b, c.*)

Test ovate, porcellaneous, with slightly roughened surface, thickest at the centre where the early quinqueloculine chambers project, periphery sharp-edged, aperture large, loop-shaped, recurved, with a slight lip and large bifurcate tooth.

Holotype from sample 11.

Dimensions of holotype : Length 1·05 mm., breadth 0·75 mm., thickness 0·30 mm.

This subspecies is consistently smaller and proportionately thicker than *M. secans secans,* when compared with Mediterranean specimens. It does not attain the broad complanate form of fully-developed specimens of the latter, but compares closely with immature specimens. The author has similar specimens from Dar-es-Salaam, Tanganyika Territory. Heron-Allen and Earland (1915) state that, in regard to Kerimba specimens, "the large compressed form is not represented at all in the dredgings . . . ", and it is considered that their figured specimens (pl. xliv, figs. 24–27) are referable to this subspecies.

(96) *Massilina corrugata* n. sp.

(Plate II, figs. 11*a, b, c* ; 12*a, b, c.*)

Test porcellaneous, dull and chalky, ovate, periphery truncate, surface of chambers transversely ridged. Microspheric specimens are quinqueloculine in form with a tendency toward complanate expansion in the last chamber, megalospheric specimens are complanate or excavated centrally. Aperture elongate, subrectangular, slightly produced and recurved, with a long, plate-like tooth.

Holotype from sample 9 (microspheric form), paratype from sample 1 (megalospheric form).

Dimensions : Holotype, length 1·14 mm., breadth 0·78 mm., thickness 0·39 mm.; paratype, length 0·89 mm., breadth 0·58 mm., thickness 0·39 mm.

This species is common in the shallow-water samples of groups 1, 2 and 3. The quinqueloculine microspheric form at first sight resembles *Quinqueloculina parkeri* (Brady), but the periphery is truncate rather than acute as in the latter species. Cushman (1921) has described a variety *occidentalis* of *Q. parkeri* having a truncate periphery, but this variety is described as having a greater number of transverse ridges than the species, which does not apply to the present form. The characters of fully-developed megalospheric specimens are those of *Massilina,* and it is hence referred to that genus.

(97) *Massilina minuta* n. sp.

(Plate III, figs. 1*a, b*,; 2.)

Test minute, finely arenaceous, smooth, elongate-ovate in outline, compressed, chambers narrow and rounded with slightly depressed sutures, early stages quinqueloculine, last three chambers massiline, apertural end produced as a neck, aperture circular, edentate, with a narrow lip.

Holotype from sample 24.

Dimensions of holotype : Length 0·34 mm., breadth 0·16 mm., thickness *ca.* 0·08 mm.

This minute but very distinctive species occurs in small numbers in most of the samples of group 3 and is common in sample 45. It has some resemblance to *Ammomassilina*, but the aperture is simple, not cribrate.

Genus *Pseudomassilina* Lacroix, 1938.

(98) *Pseudomassilina australis* (Cushman).

Massilina australis Cushman, 1932 etc., U.S. Nat. Mus. Bull. **161**, pt. 1, p. 32, pl. 8, figs. 2*a*, *b*.
? *Massilina pacificiensis* Cushman, 1924, Publ. 342, Carnegie Inst. Washington, p. 66, pl. 24, figs, 1, 2.
Pseudomassilina australis (Cushman). Lacroix, 1938, p. 3.

The specimens referred here are rather variable both in shape and decoration. Many are unornamented as in Cushman's figure of *M. australis* (loc. cit.), others have the crenulations of *M. pacificiensis*, with intermediate forms connecting the two. Cushman does not mention the obvious relationship between these two species in his description of the later one, *M. australis*, though he describes the later chambers of that species as " wrinkled ". It seems possible that the two forms are the same, in which case *M. australis* would have to be placed in the synonymy of *M. pacificiensis*. This can only be decided by examination of the types, and the question is therefore left open, the present specimens being referred to *M. australis* as the majority agree with the figure of this species.

Loeblich and Tappan (1953, p. 42) have included this species in the new genus *Pateoris*. It is however the genotype of *Pseudomassilina* Lacroix, 1938, and this name must have taken precedence, had the species been congeneric with the genotype of *Pateoris*, *P. hauerinoides* Loeblich and Tappan. However, the peculiar pitted and canaliculate shell-structure of *Pseudomassilina* is not described as a characteristic of *Pateoris*, and this genus is apparently distinct from the tropical massilines separated by Lacroix.

Genus *Spiroloculina* d'Orbigny, 1826.

(99) *Spiroloculina angulata* Cushman.

Spiroloculina grata Terquem, var. *angulata* Cushman, 1910 etc. (1917), U.S. Nat. Mus. Bull. **71**, pt. 6, p. 36, pl. 7, fig. 5.
S. angulata Cushman. Cushman and Todd, 1944, p. 50, pl. 7, figs. 18–22.

This costate species with ridged periphery is common in the samples of groups 1, 2 and 3. It has a very wide distribution in the tropical Indo-Pacific, and has been recorded from as far south as Sydney, N.S.W.

(100) *Spiroloculina aperta* Cushman and Todd.

Spiroloculina aperta Cushman and Todd, 1944, Sp. Publ. No. 11, Cushman Lab. Foram. Research, p. 66, pl. 9, figs. 21, 22.

This delicate species with concave periphery, 2 sharp keels and a produced apertural neck is fairly common in the samples of groups 2 and 3.

(101) *Spiroloculina communis* Cushman and Todd.

Spiroloculina communis Cushman and Todd, 1944, Sp. Publ. No. 11, Cushman Lab. Foram. Research, p. 63, pl. 9, figs. 4, 5, 7, 8.

This strongly-built, excavated species is one of the commonest in the samples of groups 1, 2 and 3.

(102) *Spiroloculina disparilis* Terquem.

Spiroloculina disparilis Terquem, 1878, Mém. soc. géol. France, ser. 3, **1**, p. 55, pl. 5 (10), fig. 12 ; Cushman and Todd, 1944, p. 35, pl. 5, figs. 22–31 (synonymy).

Occurs sparsely in the samples of groups 3 and 4. This species has a wide warm-water distribution, and is common in the Miocene sediments of Victoria.

(103) *Spiroloculina foveolata* Egger.

Spiroloculina foveolata Egger, 1893, Abhandl. Kön. bay. Akad. Wiss. München, cl. ii, 18, p. 274, pl. 1, figs. 33, 34 ; Cushman and Todd, 1944, p. 48, pl. 7, figs. 7–12 (synonymy).

Fine specimens of this reticulate species were not uncommon in the samples of groups 1, 2 and 3. It has a wide Indo-Pacific distribution.

(104) *Spiroloculina lucida* Cushman and Todd.

Spiroloculina lucida Cushman and Todd, 1944, Sp. Publ. No. 11, Cushman Lab. Foram. Research, p. 70, pl. 9, figs. 30, 31.

Rare in sample 10 (2 specimens). Widely distributed in the Indo-Pacific area.

(105) *Spiroloculina rugosa curvatura* Cushman and Todd.

Spiroloculina rugosa Cushman and Todd, var. *curvatura* Cushman and Todd, 1944, Sp. Publ. No. 11, Cushman Lab. Foram. Research, p. 66, pl. 9, figs. 18–20.

Occasional specimens of this subspecies were found in the samples of group 3. It was described from Samoa and is recorded also from the Red Sea and Sydney Harbour (N.S.W.).

(106) *Spiroloculina scita* Cushman and Todd.

Spiroloculina antillarum Parr, 1932 (not of d'Orbigny), p. 9, pl. 1, fig. 11.
S. scita Cushman and Todd, 1944, Sp. Publ. No. 11, Cushman Lab. Foram. Research, p. 60, pl. 8, figs. 20, 21.

Common in practically all the shallow-water samples. The specimens are generally not so large as those from southern Australian waters, but are otherwise typical.

Genus *Sigmoilina* Schlumberger, 1887.

(107) *Sigmoilina schlumbergeri* Silvestri.

Planispirina celata Brady, 1884 (not of Costa), p. 197, pl. viii, figs. 1–4.
Sigmoilina schlumbergeri Silvestri, 1904, Mem. Pont. Accad. Nuovi Lincei, **22**, p. 267 ; Cushman 1946, p. 36, pl. 6, figs. 1–4 (synonymy).

Three specimens from sample 45 had the outward appearance of this species, including the very small aperture with a rudimentary tooth, giving it a crescentic appearance. On sectioning one, it proved to be a typical *Sigmoilina*. Records of this species are mostly from the Atlantic, though Brady states that the form recorded by him is found in all the great oceans, and it is recorded by Le Roy from the late Tertiary of Siboeret Island, off Sumatra.

(108) *Sigmoilina australis* (Parr.)

Quinqueloculina australis Parr, 1932, Proc. Roy. Soc. Victoria, **44** (N.S.), pt. 1, p.6, pl. 1, figs. 7*a*, *b*.
Sigmoilina australis (Parr). Parr, 1945, p. 197.

Three typical examples were found in sample 45. It is common in shallow water on the Victorian coast.

Genus *Spirosigmoilina* Parr, 1942.

(109) *Spirosigmoilina bradyi* n. sp.

Spiroloculina crenata Brady, 1884 (not of Karrer), p. 156, pl. x, figs. 24–26.
Massilina crenata (Karrer). Cushman, 1910 etc. (1917) (not *S. crenata* Karrer), p. 57, pl. 20, fig. 2.

Specimens of the form figured by Brady (loc. cit.) were frequent in the samples of group 3. A close examination of the early chambers reveals that they are sigmoiline rather than quinqueloculine, as has been previously stated. There is some variation in the degree to which the later massiline chambers embrace the earlier-formed portion, some specimens having the sigmoiline chambers obscured. Brady's fig. 26, however, shows this character clearly. The figured specimen is one in which the crenulate development is not taken on so early as in other specimens from the same material, and hence exhibits the earlier chambers better.

As this form has the characteristic growth-plan of the genus *Spirosigmoilina* Parr, described from the Miocene of Victoria, it is accordingly removed to that genus. Cushman and Todd (1944, p. 75) have examined the types of Karrer's *Spiroloculina crenata*, and state that it is a species of *Hauerina*. A new specific name is therefore required for this recent species.

(110) *Spirosigmoilina parri* n. sp.

(Plate III, figs. 2*a*, *b*; 3.)

Test porcellaneous, subtranslucent, subcircular, smooth, complanate except for the raised fusiform initial portion, consisting of a proloculus and about 8 tubular chambers arranged in a sigmoid curve, followed by 3 or 4 compressed complanate spiroloculine chambers. Aperture simple, compressed, edentate.

Holotype from sample 45.

Dimensions of holotype: Length 0·33 mm., breadth 0·28 mm., thickness 0·06 mm.

This species resembles *S. tateana* (Howchin) to some extent, but differs from the Miocene species in its much smaller size and more compressed and spreading later chambers. It is named in honour of my old friend the late W. J. Parr, the author of the genus. The species occurs rarely in the samples of groups 3 and 4.

Genus *Articulina* d'Orbigny, 1826.

(111) *Articulina pacifica* Cushman.

Articulina pacifica Cushman, 1944, Sp. Publ. No. 10, Cushman Lab. Foram. Research, p. 17, pl. 4, figs., 14–18.

Rare in the samples of groups 2 and 3. It has a wide Indo-Pacific distribution.

(112) *Articulina tricarinata* n. sp.

(Plate III, figs. 5*a*, *b* ; 6.)

Test minute, translucent, surface somewhat rough, early chambers apparently spiroloculine, with sharply keeled periphery, later chambers uniserial, triangular in cross-section, edges sharply keeled, widest at the base of each chamber and slightly truncate. Aperture rounded, at the end of a produced and slightly flaring neck.

Holotype from sample 45.

Dimensions of holotype : Length 0·38 mm., breadth 0·05 mm.

Only two specimens were found, but the unusual and distinctive characteristics appear to justify describing it as a new species. The tricarinate form of the later chambers distinguishes it from other species of the genus.

(113) *Articulina sagra* d'Orbigny.

(Plate III, fig. 7.)

Articulina sagra d'Orbigny, 1839, *in* de la Sagra, Hist. phys. pol. nat. Cuba, " Foraminifères ", p. 183, pl. 9, figs. 23–26 ; Cushman, 1944, p. 11, pl. 2, figs. 6–10.

Cushman (loc. cit.) considers that records of this species from localities outside the West Indian region are erroneous, but the present specimens compare closely with specimens of *A. sagra* from La Chorrera, Cuba, and are considered to be conspecific. Common in some of the dredgings of group 3, a few specimens in the deeper-water sample 45. Most of the larger specimens, including the one illustrated, lack the initial series of chambers, which is triloculine, costate and usually (but not invariably) smaller in relation to the later series than in Cuban specimens.

(114) *Articulina queenslandica* n. sp.

(Plate III, figs. 8, 9 and 10.)

Test elongate, slender, commencing with a compressed spiroloculine series of from 1 to 5 chambers after the proloculus, periphery rounded, chambers sometimes taking up a complete whorl. Later chambers, up to 4 in number, are cylindrical, slightly widened at the base and ornamented with low costae, increasing from 4 or 5 on the first uniserial chamber to 12 in the last. Costae increase in height toward the oral end of each chamber and relatively so in successive chambers. Aperture terminal, round, with a narrow everted lip.

Holotype from sample 45.

Dimensions of holotype : Length 0·42 mm., breadth 0·06 mm.

Three specimens were found in sample 45. The best-developed specimen (fig. 10) which is 0·86 mm. long, would have been referred to *Nodobacularia* had it been found alone, as the early series consists of a proloculus and one spiral chamber taking up a complete whorl. Another specimen (fig. 9) shows 2 spiroloculine chambers followed by one which takes up nearly one whorl, and a third (fig. 8) which has been selected as the type, has 5 spiroloculine chambers after the proloculus, which is much smaller than in the other two specimens.

This species resembles *A. pauciloculata* Cushman, described from the West Atlantic, in its elongate form and gradation in number of costae, but the latter species has a triloculine initial series of chambers. It is noteworthy that *A. queenslandica* and *A. tricarinata* (*vide* *supra*) appear to have been derived from a spiroloculine ancestor, rather than triloculine or quinqueloculine as with other species of the genus. However, as *Articulina* is evidently a polyphyletic genus, it does not appear necessary to make any distinction other than specific.

Genus *Tubinella* Rhumbler, 1906.

(115) *Tubinella funalis* (Brady).

Articulina funalis Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 186, pl. xiii, figs. 6–11.
Tubinella funalis (Brady). Rhumbler, 1906, p. 26, pl. 2, fig. 3 ; Cushman, 1924, p. 54, pl. 19, figs. 7, 8.

Not uncommon in the samples of group 3.

(116) *Tubinella inornata* (Brady).

Articulina funalis Brady, var. *inornata* Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 186, pl. xiii, figs. 3–5.
Tubinella inornata (Brady). Rhumbler, 1906, p. 27, pl. 2, fig. 4 ; Cushman, 1924, p. 54.

One specimen of this smooth form was found in sample 45. The globose proloculus is followed by a second spiral chamber, attached and forming half a whorl, from which develops the tubular rectilinear portion.

Genus *Nubeculina* Cushman, 1924.

(117) *Nubeculina divaricata advena* Cushman.

Nubeculina divaricata (Brady), var. *advena* Cushman, 1924, Publ. 342, Carnegie Inst. Washington, p. 53, pl. 19, figs. 1–4.

Common in the samples of group 3. All the specimens were referable to this subspecies, which differs from *N. divaricata divaricata* by the close apposition of the chambers and the clavate form of the test.

Genus *Hauerina* d'Orbigny, 1839.

(118) *Hauerina diversa* Cushman.

Hauerina diversa Cushman, 1946, Contr. Cushman Lab. Foram. Research, **22**, pt. 1, p. 11, pl. 2, figs. 16–19.

This small species was described from the Paumotus. It occurs rarely in the samples of group 3.

(119) *Hauerina pacifica* Cushman, *rugosa* n. subsp.

(Plate III, figs. 11*a*, *b*, *c*.)

This subspecies differs from *H. pacifica pacifica* in the development of oblique ridges or crenulations on the later chamber walls. There is considerable variation in the degree of crenulation, some specimens being nearly smooth, others strongly ridged with fine longitudinal striae on the last chamber. Rare in the samples of group 3.

Holotype from sample 27.

Dimensions of holotype : Length 0·60 mm., breadth 0·56 mm., thickness 0·28 mm.

(120) *Hauerina fragilissima* (Brady).

Spiroloculina fragilissima Brady 1884, Rep. Voy. Chall., Zool. **9**, p. 149, pl. ix, figs. 12–14.
Hauerina fragilissima (Brady). Cushman, 1946, p. 10, pl. 2, figs. 1–6, 8 (synonymy).

Not uncommon in the samples of group 3. In the recent state the species appears to be confined to the Pacific.

(121) *Hauerina involuta* Cushman.

Hauerina ornatissima (part) Brady, 1884 (not of d'Orbigny), p. 192, pl. vii, figs. 15–17.
H. involuta Cushman, 1946, Contrib. Cushman Lab. Foram. Research, **22**, pt. 1, p. 13, pl. 2, figs. 25–28.

This is the commonest species of the genus in the present material, occurring generally in the samples of groups 1, 2 and 3. It appears to be a restricted Pacific species.

(122) *Hauerina bradyi* Cushman.

Hauerina compressa Brady, 1884 (not of d'Orbigny), p. 190, pl. xi, figs. 12, 13 ; Millett, 1898 etc. (1898), p. 610, pl. 13, fig. 11.
Hauerina bradyi Cushman 1910 etc. (1917), U.S. Nat. Mus. Bull. **71**, pt. 6, p. 62.

Frequent in the samples of group 3. It has a general Indo-Pacific distribution.

Genus *Schlumbergerina* Munier-Chalmas, 1882.

(123) *Schlumbergerina alveoliniformis* (Brady).

Miliolina alveoliniformis Brady, 1879, Quart. Journ. Micr. Sci. XIX, N.S., p. 268; 1884, p. 181, pl. viii, figs. 15–20.
Schlumbergerina alveoliniformis (Brady). Cushman, 1918 etc. (1929), p. 56.

Not uncommon in the samples of group 3. Fine specimens were found in sample 26.

Genus *Ammomassilina* Cushman, 1933.

(124) *Ammomassilina alveoliniformis* (Millett).

Massilina alveoliniformis Millett, 1898, Journ. Roy. Micr. Soc., p. 609, pl. 13, figs. 5–7 ; Heron-Allen and Earland, 1914 etc. (1915), p. 584, pl. xlv, fig. 15.
Ammomassilina alveoliniformis (Millett). Cushman, 1933, p. 32, pl. 3, figs. 5*a*, *b*.

Common in samples of group 3, especially those from off-shore stations.

Genus *Triloculina* d'Orbigny, 1826.

(125) *Triloculina bertheliniana* (Brady).

Miliolina bertheliniana Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 166, pl. cxiv, figs. 2*a*, *b*.
M. tricarinata d'Orbigny, reticulated form, Millett, 1898 etc. (1898), p. 503, pl. xi, figs. 12*a*, *b*.
M. tricarinata d'Orbigny, var. *bertheliniana* Brady. Chapman, 1900*a*, p. 174.
Triloculina bertheliniana (Brady). Cushman, 1918*a*, p. 290 ; 1921, p. 457 ; 1932, p. 60, pl. 13, fig. 5.

This well-known Indo-Pacific species is common in most of the samples of groups 1, 2 and 3. The larger specimens are not quite so regular as Brady's figure, tending to develop sinuate edges.

(126) *Triloculina bicarinata* d'Orbigny.

Triloculina bicarinata d'Orbigny, 1839, *in* de la Sagra, Hist. phys. pol. nat. Cuba, " Foraminifères ", p. 158, pl. 10, figs. 18–20 ; Cushman, 1922, p. 76, pl. 12, fig. 7 ; 1932, p. 60, pl. 13, figs. 6*a*, *c*.

This irregularly-reticulate form with truncate chambers is not uncommon in the samples of groups 1, 2 and 3. Cushman has recorded it from various stations in the tropical Pacific.

(127) *Triloculina littoralis* n. sp.

(Plate III, figs. 12*a*, *b*, *c*.)

Test porcellaneous, white and polished, ovate in side view with 3 chambers visible, subtriangular in end view with broadly-rounded periphery. Chambers strongly embracing at ends, costate. Apertural end produced as a short neck, aperture oval with everted lip and large thin tooth.

Holotype from sample 7.

Dimensions of holotype : Length 0·40 mm., breadth 0·22 mm., thickness 0·16 mm.

This small species is common in most of the samples of groups 1, 2 and 3, and is more frequent than usual in the mangrove-pool samples. It resembles the form figured by Heron-Allen and Earland (1915, pl. xlii, figs. 7–9) as *Miliolina cultrata* Brady, striate form, but differs in its rounded periphery.

(128) *Triloculina oblonga* (Montagu).

Vermiculum oblongum Montagu, 1803, Test. Brit., p. 522, pl. 14, fig. 9.
Triloculina oblonga (Montagu). d'Orbigny, 1826, p. 304, no. 16.

Elongate smooth triloculine specimens with rounded periphery, large rounded aperture and narrow simple tooth are referred to this species. They are common in the samples of groups 1, 2 and 3.

(129) *Triloculina quadrata* n. sp.

(Plate III, figs. 13*a*, *b*, *c*.)

Test porcellaneous, 3 chambers visible externally, surface irregularly pitted but shining, ovate in side view, chambers broadly truncate with a rounded keel on each angle, apertural end produced in a short neck, aperture oval with a small simple tooth.

Holotype from sample 25.

Dimensions of holotype : Length 0·90 mm., breadth 0·65 mm., thickness 0·53 mm.

This species is somewhat similar to *T. quadrilateralis* d'Orbigny, but differs in its produced neck and circular aperture. It also resembles *Massilina annectens* d'Orbigny, from which it differs in being clearly triloculine, and also in the apertural features.

(130) *Triloculina sublineata* (Brady) ?

(Plate III, figs. 14*a*, *b*.)

? *Miliolina circularis* Bornemann, var. *sublineata* Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 169, pl. iv, figs. 7*a–c*.
M. circularis Bornemann, var. *sublineata* Brady. Millett, 1898 etc. (1898), p. 501, pl. xi, fig. 4 ; Heron-Allen and Earland, 1914 etc. (1915), p. 558, pl. xli, figs. 9–11.

All the specimens found were thin-shelled and translucent, with the cribrate aperture figured by Millett. Whether this is the same form as Brady's var. *sublineata* is open to doubt.

Brady's figure shows an arcuate aperture without a tooth, and appearing to be closed by what might be interpreted as a finely cribrate plate (fig. 7*c*), but his description does not mention this. Heron-Allen and Earland's fig. 11 shows an oval cribrate aperture which may be somewhat conventionalized. The question can only be resolved by the examination of Brady's figured specimens, and is therefore left open.

The species is not uncommon in the samples of groups 1, 2 and 3.

(131) *Triloculina subrotunda* (Montagu).

Vermiculum subrotundum Montagu, 1803, Test. Brit., p. 521.
Triloculina subrotunda Parr, 1950, p. 293 (synonymy).

Typical examples were fairly common in the shallow-water samples of groups 1 and 2.

(132) *Triloculina terquemiana* (Brady).

Miliolina terquemiana Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 166, pl. cxiv, figs. 1*a*, *b*.

The degree of striation in this species appears to be variable, also the degree of inflation of the chambers, as noted by Heron-Allen and Earland (1915, p. 563). It is common throughout the samples of groups 1, 2 and 3. Records range from the western Indian Ocean to the Ellice Islands.

(133) *Triloculina transversistriata* (Brady).

Miliolina transversistriata Brady, 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, N.S., p. 45; 1884, Rep. Voy. Chall., Zool. **9**, p. 177, pl. iv, figs. 6*a.c*.

This well-marked species occurred in small numbers in many of the samples of groups 1 and 2.

(134) *Triloculina tricarinata* d'Orbigny.

Triloculina tricarinata d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 299, no. 7, Modèles no. 94.

Specimens referable to this wide-ranging species were frequent in most of the samples of groups 1, 2 and 3.

Genus *Edentostomina*, n. gen.

Test triloculine or rarely biloculine, compressed, ovate in outline, last 2 chambers added at approximately 180°, periphery sharp or carinate, aperture oval with a thickened rim and no tooth. Genotype *Miliolina cultrata* Brady.

Millett (1898), in describing *Miliolina durrandii*, states " This is one of an interesting group in which the aperture is a large elliptical or fusiform opening without teeth ", and includes *M. cultrata* and *M. rupertiana* in this edentate group.

Heron-Allen and Earland, 1914 etc. (1915) group the same species together as the " Group of *M. cultrata* (edentate) ". This appears to be a useful natural grouping which should be recognized in nomenclature, the main point of difference from *Triloculina* s. str. being the large oval and edentate aperture. It is considered that *Pyrgo milletti* Cushman, which was originally described as a variety of *Miliolina durrandii*, should also be included in this genus, as its affinities appear to be closer to this group than to any described species of *Pyrgo*.

The species included in this genus appear to be confined to the Indo-Pacific region, where the genus has developed in Recent times.

(135) *Edentostomina cultrata* (Brady).

Miliolina cultrata Brady, 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, N.S., p. 45 ; 1884, p. 161, pl. v, figs. 1, 2.

Found in small numbers in many of the samples of group 3.

(136) *Edentostomina durrandii* (Millett).

Miliolina durrantii Millett, 1898, Journ. Roy. Micr. Soc., p. 268, pl. vi, figs. 7–16 ; Heron-Allen and Earland, 1914 etc. (1915), p. 565, pl. xlii, figs. 11–16.

Not uncommon in the samples of group 3. Practically all the specimens are striate, only the immature tests being smooth, and then having slight striations near the apertural end of the chamber.

(137) *Edentostomina rupertiana* (Brady).

Miliolina rupertiana Brady 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, N.S., p. 46 ; 1884, p. 178, pl. vii, figs. 7–12 ; Millett, 1898 etc. (1898), p. 269, pl. vi, fig. 13 ; Heron-Allen and Earland, 1914 etc. etc. (1915), p. 565.

This beautifully decorated species was fairly common in the samples of group 3, some very large specimens being found.

(138) *Edentostomina milletti* (Cushman).

Miliolina durrandii Millett (part), 1898, Journ. Roy. Micr. Soc., p. 268, pl. vi, figs. 8–10 (not 7).
Biloculina milletti Cushman, 1910 etc. (1917), U.S. Nat. Mus. Bull. **71**, 4, p. 479.
Pyrgo milletti (Cushman). Cushman, 1918 etc. (1929), p. 68, pl. 19, fig. 1.

Biloculine specimens referable to Cushman's species occurred in the samples of group 3. In their compressed form, keeled edge and oval toothless aperture they resemble other species in this group, in which some specimens occur with the antepenultimate chamber only just visible between the embracing later chambers. The small increase in overlap of the last chamber needed to make the test biloculine instead of triloculine is considered to be of little weight as a character compared with the points of resemblance with other species of the genus, and it is therefore included in *Edentostomina*.

Genus *Pyrgo* Defrance, 1824.

(139) *Pyrgo striolata* (Brady).

Biloculina ringens (Lamarck), var. *striolata* Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 143, pl. iii, figs. 7, 8.

Occasional specimens were found in samples of all groups, but it was best represented in the deeper-water samples of group 4.

(140) *Pyrgo denticulata* (Brady).

Biloculina ringens (Lamarck), var. *denticulata* Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 143, pl. iii, figs. 4, 5.
Pyrgo denticulata (Brady). Cushman, 1918 etc. (1929), p. 69, pl. xviii, figs. 3, 4 ; Parr, 1950, p. 296.

Occasional specimens were found in the samples of groups 1, 2 and 3, and it was common in sample 53. Specimens without the basal serration occur, as noted by Parr in southern

Australian waters, but these are otherwise inseparable from serrate specimens in the same material.

(141) *Pyrgo subglobulus* Parr.

Pyrgo subglobulus Parr, 1950, B.A.N.Z.A.R. Exped. Rept. V, pt. 6, Foram., p. 298, pl. vii, figs. 10*a*.*c*.

Four specimens were found in sample 45. This species was described from off Tasmania.

(142) *Pyrgo depressa* (d'Orbigny).

Biloculina depressa d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 298, no. 7 ; Modèles no. 91 ; Brady, 1884, p. 145, pl. ii, figs. 12, 15–17, pl. iii, figs. 1, 2.
Pyrgo depressa (d'Orbigny). Cushman, 1918 etc. (1929), pt. 6, p. 71, pl. 19, figs. 4, 5.

This wide-ranging species occurred fairly frequently in the samples of groups 1, 2 and 3.

Family OPHTHALMINIDAE.

Genus *Cornuspira* Schultze, 1854.

(143) *Cornuspira involvens* Reuss.

Operculina involvens Reuss, 1850, Denkschr. d. k. Akad. Wiss. Wien, **1**, p. 370, pl. xiv, fig. 20.
Cornuspira involvens Reuss, 1863, Sitzungsb. d. k. Akad. Wiss. Wien, XLVIII, p. 39, pl. i, fig. 2 ; Brady, 1884, p. 200, pl. xi, figs. 1–3.

Frequent in the finer fractions of the samples of groups 1, 2 and 3. Specimens were invariably small, not more than 0·25 mm. in diameter, with 4 to 5 convolutions.

Genus *Cornuspirella* Cushman, 1928.

(144) *Cornuspirella diffusa* (Heron-Allen and Earland).

(Plate III, fig. 16.)

Cornuspira diffusa Heron-Allen and Earland, 1913, Journ. Roy. Micr. Soc., pp. 272–276, pl. 12 ; Earland, 1933, p. 51, pl. 1, figs. 5–7 ; 1934, p. 52.
Cornuspirella diffusa (Heron-Allen and Earland). Cushman, 1928*a*, p. 4, pl. 1, fig. 14.

Two fragments of tests, from samples 24 and 25 respectively, are referable to this widely-distributed species, which was described from the eastern North Atlantic and is recorded also from the Antarctic. The occurrence is noteworthy, since records are generally from cold-water areas.

Genus *Nodophthalmidium* MacFadyen, 1939.

(145) *Nodophthalmidium simplex* Cushman and Todd.

Nodophthalmidium simplex Cushman and Todd, 1944, Contrib. Cushman Lab. Foram. Research, **20**, pt. 3, p. 67, pl. 11, fig. 8.

Five specimens from sample 45, lacking initial chambers, are referable to this species. One has 4 elongate-pyriform chambers and reaches a length of 1·1 mm.

(146) *Nodophthalmidium gracilis* n. sp.

(Plate III, fig. 15.)

Articulina conico-articulata Millett 1898 (not of Batsch), Journ. Roy. Micr. Soc., p. 511, pl. xii, figs. 9, 10*a*–*c*.

Test elongate, slightly curved, circular in cross-section, early portion consisting of a spherical proloculus and a short planispiral tube of less than one whorl in length, merging into a rectilinear series of long slender chambers, widest just above the suture and tapering to the oral end, wall ornamented by 8–10 high sharp costae, in some specimens terminated by a basal spine, aperture terminal, round, with an everted lip.

Holotype from sample 45.

Dimensions of holotype: Length 0·75 mm., breadth 0·12 mm.

This is the species figured by Millett and later referred by Cushman to his *N. milletti*, described from Fiji. It differs from the latter species in the consistently longer and more slender chambers with fewer costae. Common in sample 45 and occasional in the samples of group 3.

Genus *Nodobaculariella* Cushman and Todd.

(147) *Nodobaculariella rustica* Cushman and Todd.

Nodobaculariella rustica Cushman and Todd, 1944, Contrib. Cushman Lab. Foram. Research, **20**, pt. 3, p. 73, pl. 12, figs. 4, 5.

This species, described from the Phillippines and recorded also from the Paumotus, was rare in sample 26.

Genus *Vertebralina* d'Orbigny, 1826.

(148) *Vertebralina striata* d'Orbigny.

Vertebralina striata d'Orbigny, 1826, Ann. Sci. Nat. XII, p. 283; Modèles no. 81.

This widely-distributed species was not uncommon in the samples of group 3.

Genus *Ophthalmidium* Zwingli and Kubler, 1870.

(149) *Ophthalmidium inconstans* (Brady).

Hauerina inconstans Brady, 1879 etc., Quart, Journ. Micr. Sci. XIX, n.s., p. 54.
Ophthalmidium inconstans (Brady). Brady, 1884, p. 189, pl. xii, figs. 5, 7, 8.

One large winged specimen was found in sample 45.

(150) *Ophthalmidium circularis* (Chapman), *tropicalis* n. subsp.

(Plate IV, figs. 1*a*, *b*.)

Test subcircular, commencing with a proloculus and a short spiral tube, then becoming septate and irregularly spiroloculine. Chambers narrow and deep, connected to the chambers of earlier whorls by a thin plate which is discontinuous, being broken by gaps along the line of attachment to earlier whorls. Periphery slightly concave, chambers irregular in outline, apertural end tapering to a small round aperture at the end of a long neck.

Holotype from sample 45.

Dimensions of holotype: Diameter 0·25 mm., thickness 0·10 mm.

This subspecies differs from *O. circularis circularis* (Chapman, 1915, p. 7, pl. 1, fig. 1; 1941, p. 186) in the more angular and irregular outline of the later chambers and in the discontinuity of the plate connecting successive whorls. Young specimens are hardly separable from Chapman's species, but the adult test is quite distinctive. Eleven specimens were found, all in sample 45.

Genus *Polysegmentina* Cushman, 1946.

(151) *Polysegmentina circinata* (Brady).

Hauerina circinata Brady, 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, n.s., p. 17 ; 1884, p. 191, pl. xi, figs. 14–16.
Polysegmentina circinata (Brady). Cushman, 1946, p. 1, pl. 1, figs. 1–4 (synonymy).

This species was common in the shallow-water samples, particularly in those of group 3. It is a characteristic species of the muddy coastal waters of North Queensland.

Genus *Planispirinella* Wiesner, 1931.

(152) *Planispirinella exigua* (Brady).

Planispirina exigua Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 196, pl. xii, figs. 1–4, text-figs. 5, 6.
Planispirinella exigua (Brady). Wiesner, 1931, p. 69.

Common in the samples of groups 3 and 4.

(153) *Planispirinella involuta* n. sp.

(Plate IV, figs. 2*a*, *b*.)

Test porcellaneous, planispiral, with 3 chambers making up the last whorl, compressed and discoidal, thickest at the centre, involute. Sutures radial, straight, recurved near periphery, very slightly depressed. Chambers commence with a proloculus followed by a spiral tube of 2–3 whorls, then becoming septate with 3 chambers to the whorl. The chambers are tubular and peripheral, but have alar extensions reaching to the centre of the test and covering the earlier whorls ; the hollow tubular portion of the last 3 chambers appears as a semi-translucent border. The aperture is oblique to the periphery and consists of the open end of the tubular chamber.

Holotype from sample 45.

Dimensions of holotype : Diameter 0·41 mm., thickness 0·09 mm.

This species is distinct from *P. exigua* (Brady) which occurs in the same material, the difference lying in the more circular outline and the involute character of the later chambers. Four specimens were found in sample 45 only.

Genus *Wiesnerella* Cushman, 1933.

(154) *Wiesnerella auriculata* (Egger).

Planispirina auriculata Egger, 1893, Abhandl. kön. bay. Akad. Wiss. Munchen, cl. ii, 18, Abt. 2, p. 245, pl. iii, figs. 13, 15 ; Heron-Allen and Earland, 1914 etc. (1915), p. 590, pl. xlvi, figs. 3–7.
Ophthalmidium cornu Chapman, 1901, p. 408, pl. 36, fig. 1.
Wiesnerella auriculata (Egger). Cushman, 1933, p. 33.

Not uncommon in the samples of groups 1, 2 and 3. Chapman's species from Funafuti is apparently the same as Egger's earlier-described form. A closely allied species is found in the Miocene clays of Batesford, Victoria.

Genus *Nubecularia* Defrance, 1825.

(155) *Nubecularia decorata* Heron-Allen and Earland.

Nubecularia lucifuga Defrance, var. *decorata* Heron-Allen and Earland, 1914 etc. (1915), Trans. Zool. Soc. London, **20**, pt. 17, p. 549, pl. xl, figs. 6, 7.

A small form occurring attached to shell fragments in sample 2 is referred to the above species, though the surface appears to be granular rather than pustulate. The invariably rectilinear growth of this species is sufficient to separate it from *N. lucifuga*, which occurs commonly in the coastal waters of southern Australia.

Genus *Nubeculopsis* n. gen.

Test porcellaneous, adherent, chambers low-domed, commencing with a proloculus followed by 2 reniform chambers each taking up nearly half a whorl, continuing with a a series of arcuate chambers in a spiral which may reverse its direction after the first 3 or 4 chambers, becoming irregularly uniserial or with tubular chambers piled above the earlier spiral series. Aperture in the early chambers a simple opening at the distal end of the chambers, in the later tubular chambers a flaring lipped opening of the full width of the chamber.

This genus differs from *Nubecularia* in being septate throughout, without any cornuspirine spiral tube.

(156) *Nubeculopsis queenslandica* n. sp.

(Plate IV, figs. 3*a*, *b*, *c*.)

Species with the characters of the genus.

Holotype from sample 40, at which the species is rare.

Dimensions of holotype : Greatest diameter 0·82 mm.

Genus *Parrina* Cushman, 1931.

(157) *Parrina bradyi* (Millett).

Nubecularia inflata Brady 1884 (not of Terquem), p. 135, pl. i, figs. 5–8.
N. bradyi Millett, 1898, Journ. Roy. Micr. Soc., p. 261, pl. v, figs. 6*a*, *b*.
Parrina bradyi (Millett). Cushman, 1931, p. 20.

Not uncommon in the samples of groups 1, 2 and 3.

Family PENEROPLIDAE.

Genus *Peneroplis* Montfort, 1808.

(158) *Peneroplis planatus* (Fichtel and Moll).

Nautilus planatus, var. *β*, Fichtel and Moll, 1798, Test. Micr., p. 91, pl. xvi, figs. 1*d*, *e*, *f*.
Peneroplis planatus (Fichtel and Moll). d'Orbigny, 1826, p. 285, no. 1 ; Modèles no. 16.

Common in the samples of groups 1, 2 and 3. This species is widely distributed on the Australian coast, except for the cooler waters of Bass Strait.

(159) *Peneroplis pertusus* (Forskål).

Nautilus pertusus Forskål, 1775, Descr. Anim., p. 125, no. 65.
Peneroplis pertusus (Forskål). Jones, Parker and Brady, 1865, p. 19.

Present in most of the samples of groups 1, 2 and 3, but not so common as *P. planatus*.

(160) *Peneroplis arietinus* (Batsch).

Nautilus (*Lituus*) *arietinus* Batsch, 1791, Conch. Seesandes, p. 4, pl. vi, fig. 15c.
Peneroplis arietinus (Batsch). Parker, Jones and Brady, 1865, p. 26, pl. 1, fig. 18.

Well-grown specimens were fairly common in the samples of group 3.

Genus *Spirolina* Lamarck, 1804.

(161) *Spirolina cylindraceus* Lamarck.

Spirolina (*Spirolinites*) *cylindraceus* Lamarck, 1804, Ann. Mus. V, p. 245, No. 2.

Fine specimens were found in the samples of group 3, with as many as 18 chambers in the rectilinear portion. Occasional specimens occurred in the samples of groups 1 and 2.

Genus *Monalysidium* Chapman, 1900.

(162) *Monalysidium politum* Chapman.

Peneroplis (*Monalysidium*) *polita* Chapman, 1900, Journ. Linn. Soc., Zool. **28**, p. 4, pl. 1, fig. 5.
Monalysidium polita Chapman. Heron-Allen and Earland, 1914 etc. (1915), p. 603, text-fig. 43*g*.

Occasional specimens were found in the samples of groups 1, 2 and 3. Specimens with as many as 10 chambers were found, but in each case the earliest chamber was exactly the same as the rest, and perforated at the base.

Genus *Sorites* Ehrenberg, 1839.

(163) *Sorites marginalis* (Lamarck).

Orbulites marginalis Lamarck, 1816, Hist Nat. Anim. sans Vert. II, p. 196, No. 1.
Sorites marginalis (Lamarck). Cushman, 1918 etc. (1930), p. 49, pl. 18, Figs. 1–4.

Rather rare in the samples of group 3. Specimens up to 3·9 mm. in diameter were found. A few juvenile specimens were present in the deeper-water sample 45.

Genus *Amphisorus* Ehrenberg, 1840.

(164) *Amphisorus duplex* (Carpenter).

Orbitolites duplex Carpenter, 1883, Zool. Chall. Exped., pt. XXI, p. 25, pl. iii, figs. 8–14 ; pl. iv, figs. 6–10 ; pl. v, figs. 1–13 ; Brady, 1884, p. 216, pl. xiv, fig. 7.
Amphisorus duplex (Carpenter). Said, 1949, p. 25, pl. 3, fig. 1.

This species, recently re-established by Said for forms which differ from the genotype (*A. hemprichii* Ehrenberg) in being thinner, with rounded periphery and oval chambers, is usually present in small numbers together with *Marginopora vertebralis* (*vide infra*) in the samples of groups 1, 2 and 3. The record by the author of *A. hemprichii* from the Pleistocene of western Victoria (Collins, 1953) was erroneous, and should refer to the present species. It has, however, not been recorded from southern Australian waters, and its southward limit in the coastal waters of eastern Australia does not appear to have yet been established.

Genus *Marginopora* Blainville, 1830.

(165) *Marginopora vertebralis* Quoy and Gaimard.

Marginopora vertebralis Quoy and Gaimard, 1833, Voy. de Astrolabe, *fide* Blainville 1834, Man. d'Actinologie, p. 412, pl. lxix, figs. 6*a–c* ; Cushman, 1932 etc. (1933), p. 67, pl. 19, figs. 11, 12.
Orbitolites complanata of authors (not of Lamarck).

This is the commonest large foraminifer of the Barrier Reef islands, forming a major constituent of the beach sands of the region. So well known is it that the tests are dyed in various colours and strung into necklaces for sale to tourists visiting the island resorts.

It is recorded from the Upper Pliocene of Adelaide and the Pleistocene of York Peninsula, South Australia. Chapman and Parr have recorded it in the Recent state from the Great Australian Bight, but it does not occur in the cooler waters of the south-east coast. Its southward limits on the east coast do not appear to have been determined. Specimens in the present material range up to 2·2 cm. in diameter (sample 31) but the usual shore-sand specimens rarely reach more than 1 cm.

Family ALVEOLINIDAE.

Genus *Alveolinella* H. Douvillé, 1906.

(166) *Alveolinella quoyi* (d'Orbigny).

Alveolina quoyi d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 306, pl. 17, figs. 11, 13.
Alveolinella quoyi (d'Orbigny). Douvillé, 1906, p. 585.
Alveolina boscii of authors (not of Defrance).

Both the megalospheric and microspheric forms were found in the samples of group 3, the former being much more common. It was not usually present in the beach sands, possibly because its elongate shape resists transportation by waves and currents to a greater degree than the discoidal forms which are predominant in the coarser fractions of these samples. Occasional juvenile specimens were found in the deeper-water samples of group 4, where local currents had probably transported them in the embryonic stage.

Family FISCHERINIDAE.

Genus *Fischerina* Terquem, 1878.

(167) *Fischerina pellucida* Millett.

(Plate IV, fig. 4.)

Fischerina pellucida Millett, 1898, Journ. Roy. Micr. Soc., p. 611, pl. xiii, figs. 14, 15.

Two specimens were found in sample 45. One has the shell wall finely pitted and may be distinct.

Superfamily LAGENIDEA.

Family Lagenidae.

Genus *Lagena* Walker and Jacob, 1798.

(168) *Lagena ampulla-distoma* Rymer Jones.

Lagena vulgaris Williamson, var. *ampulla-distoma* Rymer Jones, 1872, Trans. Linn. Soc., London, XXX, p. 63, pl. xix, fig. 52.

Rare, one specimen from sample 44.

(169) *Lagena auriculata* Brady ?

? *Lagena auriculata* Brady, 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, n.s., p. 61 ; 1884, p. 487, pl. lx, figs. 29, 31, 33.
L. auriculata Brady. Sidebottom, 1912, p. 420, pl. 20, figs. 13, 14.

One specimen of the variety illustrated by Sidebottom in figs. 13 and 14 was found. This variety has very little in common with Brady's fig. 29, which, as the first illustrated, must presumably be taken as the type of *L. auriculata*. It appears to be closer to *L. formosa* Schwager, from which it differs only in the splitting of the single keel to form a loop-shaped double keel.

(170) *Lagena chasteri* Millett.

Lagena chasteri Millett, 1901, Journ. Roy. Micr. Soc., p. 11, pl. 1, fig. 11.

Typical specimens were found in sample 23.

(171) *Lagena elongata* (Ehrenberg).

Miliola elongata Ehrenberg, 1854, Mikrogeologie, pl. xxv, fig. 1.
Lagena elongata (Ehrenberg). Brady, 1884, p. 457, pl. lvi, fig. 29.

This elongate, parallel-sided species was frequent in the finer fractions of the shallow-water samples of groups 1, 2 and 3.

(172) *L. gracillima* (Seguenza).

Amphorina gracillima Seguenza, 1862, Foram. Monotal. Messina, p. 51, pl. 1, fig. 31.
Lagena gracillima (Seguenza). Jones, Parker and Brady, 1866, p. 45, pl. 1, figs. 36, 37.

Fusiform specimens, widest at the middle and tapering conically toward the extremities and having a phialine neck and lip, are referred to this species. They were common in the samples of groups 1, 2 and 3.

(173) *Lagena laevis* (Montagu).

Vermiculum laeve Montagu, 1803, Test. Brit., p. 524.
Lagena laevis (Montagu). Williamson, 1848, p. 12, pl. 1, figs. 1, 2.

Smooth bottle-shaped specimens with rounded base and phialine neck and lip are referred to this species. They were occasional in the samples of group 3.

(174) *Lagena pacifica* Sidebottom.

Lagena pacifica Sidebottom, 1912, Journ. Quekett Micr. Club, II, p. 398, pl. 16, fig. 29.

One specimen identical with Sidebottom's figure was found in sample 45.

(175) *Lagena perlucida* (Montagu).

Vermiculum perlucidum Montagu, 1803, Test. Brit., p. 525, pl. 14, fig. 3.
Lagena perlucida (Montagu). Cushman and McCulloch, 1950, p. 342, pl. 46, figs. 1, 2 (synonymy).

Common in samples of groups 1, 2 and 3.

(176) *Lagena spiralis* Brady.

Lagena spiralis Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 468, pl. cxiv, fig. 9.
L. striato-punctata Parker and Jones, var. *spiralis* Brady. Millett, 1898 etc. (1901), p. 489, pl. viii, fig. 7; Cushman and McCulloch, 1950, p. 353, pl. 47, figs. 17, 18 (synonymy).

Occasional specimens were found in the samples of group 3. Quite similar specimens are found in the Miocene of Victoria, and the consistent variation of this form from *L. striato-punctata* s. str. over a long period of time appears to justify its specific rank as originally described by Brady.

(177) *Lagena striato-punctata* Parker and Jones.

Lagena striata (d'Orbigny), var. *striato-punctata* Parker and Jones, 1865, Phil. Trans. CLV, p. 350, pl. xiii, figs. 25–27.
L. striato-punctata Parker and Jones. Brady, 1884, p. 468, pl. lviii, figs. 37, 40.

Rare in sample 45 (one specimen).

(178) *Lagena striata* (d'Orbigny).

Oolina striata d'Orbigny, 1839, Foram. Amer. Merid., p. 21, pl. v, fig. 12.
Lagena striata (d'Orbigny). Brady, 1884, p. 460, pl. lvii, figs. 22, 24, 28, 29 etc.

Flask-shaped, finely-striate specimens with an apiculate base and a produced annulate neck have been referred to this species. This is perhaps the commonest species of the genus in the samples of groups 1, 2 and 3.

(179) *Lagena sulcata* Walker and Jacob.

Serpula (*Lagena*) *sulcata* Walker and Jacob, 1798, Adams' Essays, Kanmacher's Edn., p. 634, pl. xiv, fig. 5.

Flask-shaped specimens with bold costae set widely apart have been referred to this species. They are common in samples of all groups.

Genus *Oolina* d'Orbigny, 1839.

(180) *Oolina hexagona* (Williamson).

Entosolenia squamosa (Montague) var. *hexagona* Williamson, 1848, Ann. Mag. Nat. Hist., ser. 2, p. 20, pl. ii, fig. 23.
Oolina hexagona (Williamson). Parr, 1950, p. 304.

Rare in sample 45.

(181) *Oolina pseudocatenulata* (Chapman and Parr).

Lagena pseudocatenulata Chapman and Parr, 1937, Aust. Antarctic Exped. 1911–14, **1**, pt. 2, 332, pl. vi, figs. 75, 76.
Oolina pseudocatenulata (Chapman and Parr). Parr, 1950, p. 301, pl. viii, fig. 5.

Common in sample 45. This species was described from the Antarctic.

(182) *Oolina squamosa* (Montagu).

Vermiculum squamosum Montagu, 1803, Test. Brit., p. 526, pl. xiv, fig. 2.
Oolina squamosa (Montagu). Parr, 1950, p. 303.

Rare in sample 45.

Genus *Fissurina* Reuss, 1850.

(183) *Fissurina contusa* Parr.

Fissurina contusa Parr, 1945, Proc. Roy. Soc. Victoria, **56**, N.S., pt. ii, p. 203, pl. xix, fig. 6.

This is the form recorded by Brady (1884) from Raine Island, as ? *Lagena castrensis* Schwager. One specimen from sample 23 is closely similar to Brady's fig. 3, pl. cx, on which Parr's species was based.

(184) *Fissurina clathrata* (Brady).

Lagena clathrata Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 485, pl. lx, fig. 4.
Fissurina clathrata (Brady). Parr, 1950, p. 310.

Two good examples from sample 45.

(185) *Fissurina formosa brevis* (Brady).

Lagena formosa Schwager, var. *brevis* Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 484, pl. cxiv, fig. 10.

One specimen of this beautiful form was found in sample 45. It was described from Raine Island. It is considered here as a subspecies of *F. formosa*, which in the typical form does not occur in this material, but may prove to be a separate species.

(186) *Fissurina lacunata* (Burrows and Holland).

Lagena castrensis Brady (not of Schwager), 1884, Rep. Voy. Chall., Zool. **9**, p. 485, pl. lx, figs. 1, 2.
L. lacunata Burrows and Holland, 1895, *in* Jones, Pal. Soc., vol. for 1895, p. 205, pl. 7, figs. 12*a*, *b*.
Fissurina lacunata (Burrows and Holland). Parr, 1945, p. 203.

Specimens similar to Brady's fig. 2, which was drawn from a Raine Island specimen, occur occasionally in the samples of groups 3 and 4. The species ranges as far south as Bass Strait. In sample 45 there were several examples of the form in which the surface pitting is replaced by a delicate hexagonal network merging into costae, *vide* Cushman 1932 etc. (1933), p. 27, pl. 7, figs. 2, 3, 4 and 5. Insufficient material was available to confirm Cushman's opinion that this form intergrades with the typical pitted form.

(187) *Fissurina lagenoides* (Williamson).

Entosolenia marginata Walker and Boys, var. *lagenoides* Williamson, 1858, Rec. Foram. Gt. Brit., p. 11, pl. i, figs. 25, 26.
Lagena lagenoides (Williamson). Brady, 1884, p. 479, pl. lx, figs. 6, 7, 9 and 12.
Fissurina lagenoides (Williamson). Parr, 1947, p. 122.

Rare in sample 29 (1 specimen).

(188) *Fissurina sublagenoides* (Cushman).

Lagena lagenoides (Williamson). Brady, 1884, Rep. Voy. Chall., Zool. **9**, (*pars*), pl. lx, figs. 13, 14.
L. sublagenoides Cushman, 1910 etc. (1913), U.S. Nat. Mus. Bull. 71, pt. 3, p. 40, pl. 16, fig. 4.

Occasional specimens were found in samples of groups 3 and 4.

(189) *Fissurina lucida* (Williamson).

Entosolenia marginata Walker and Boys var. *lucida* Williamson, 1858, Rec. Foram. Gt. Brit., p. 10, pl. 1, figs. 22, 23.
Lagena lucida (Williamson). Sidebottom, 1904 etc. (1906), p. 6, pl. i, figs. 9.12.

Common in the finer fractions of samples of groups 1, 2 and 3. Specimens are of the type illustrated by Sidebottom's figs. 10*a*, *b*.

(190) *Fissurina marginato-perforata* (Seguenza).

Lagena marginato-perforata Seguenza, 1880, Atti. Accad. Lincei, ser. 3, **6**, p. 332, pl. 17, fig. 34 ; Cushman, 1932 etc. (1933), p. 19, pl. 5, figs. 1*a*, *b*, pl. 6, figs. 1*a*, *b*, pl. 4, figs. 13*a*, *b*.

Frequent in samples of all groups.

(191) *Fissurina orbignyana* Seguenza.

Fissurina orbignyana Seguenza, 1862, Foram. Monotal. Messina, p. 66, pl. ii, figs. 25, 26.

Not uncommon and generally distributed in all groups.

(192) *Fissurina walleriana* (Wright).

Lagena orbignyana (Seguenza) var. *walleriana* Wright, 1886, Proc. Roy. Irish Acad., ser. 2, **4**, p. 611.

Rare in sample 45 (2 specimens).

(193) *Fissurina radiato-marginata* (Parker and Jones).

Lagena radiato-marginata Parker and Jones, 1865, Phil. Trans. CLV, p. 355, pl. xviii, figs. 3*a*, *b*.

One example of this species was found in sample 45.

(194) *Fissurina semistriata* (Uchio).

Entosolenia semistriata Uchio, 1950, Assoc. Petr. Technol. Journ. (Tokyo).

A compressed, pyriform, keeled *Fissurina* with 6 or more fine costae curving up from the base for about one-third the height of the test is referred to this species, which was described from the Upper Pliocene of Japan. The generic name *Entosolenia* was shown by Parr (1945, p. 119) to be a synonym of d'Orbigny's *Oolina*. Rare in sample 45.

(195) *Fissurina staphyllearia* Schwager.

Fissurina staphyllearia Schwager, 1866, Novara-Exped., Geol. Theil. **2**, p. 209, pl. 5, fig. 24.

Three typical specimens from sample 45.

(196) *Fissurina wrightiana* (Brady).

Lagena wrightiana Brady, 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, N.S., p. 62; 1884, p. 482, pl. lxi, figs. 6, 7.

Rare in sample 32.

(197) *Fissurina varioperforata* (Buchner).

Lagena varioperforata Buchner, 1940, Nova Acta Leop. **9**, 62, p. 494, pl. 18, figs. 353–358.

This species is characterized by the coarse tubulation of the wall, leaving a narrow elliptical area of clear shell-wall in the centre of the test, through which can be seen a straight entosolenian tube extending about half-way down the test. Specimens from sample 45 appear to fall within the limits of variation illustrated by Buchner. The type was from the Mediterranean.

Genus *Parafissurina* Parr, 1945.

(198) *Parafissurina unguis* (Heron-Allen and Earland).

Lagena unguis Heron-Allen and Earland, 1913*a*, Proc. Roy. Irish Acad. **31**, p. 86, pl. 7, figs. 1–3.

One specimen of this wide-ranging but rare species was found in sample 45.

Genus *Nodosaria* Lamarck, 1812.

(199) *Nodosaria calomorpha* Reuss.

Nodosaria calomorpha Reuss, 1865, Denschr. d. k. Akad. Wiss. Wien. XXV, p. 129, pl. 1, figs. 15–19.

Eight specimens of this small but distinctive species were found in sample 45.

(200) *Nodosaria proxima* Silvestri.

Nodosaria proxima Silvestri, 1872, Nodos. Foss. e Viv. d'Ital., p. 63, pl. vi, figs. 138–147.

Two-chambered nodosarians with 8–10 costae occur rarely in the samples of groups 3 and 4, and are referred to this species, which was recorded from Raine Island by Brady.

(201) *Nodosaria pyrula* d'Orbigny.

Nodosaria pyrula d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 253, no. 13.

Eight specimens were found in sample 45. Several show the elongate fusiform initial chamber which is usually missing from the fragile test of this species.

Genus *Dentalina* d'Orbigny, 1826.

(202) *Dentalina antarctica* Parr.

Dentalina antarctica Parr, 1950, B.A.N.Z.A.R. Exped. Rep. V, pt. 6, p. 320, pl. xi, figs. 26, 27.

One specimen from sample 45 is very close to the megalospheric specimen illustrated by Parr (fig. 27).

(203) *Dentalina californica* Cushman and Gray.

Dentalina californica Cushman and Gray, 1946, Contrib. Cushman Lab. Foram. Res. **22**, pt. 2, p. 66. pl. 12, figs. 3–5.

A slender form with oblique chambers and a long acuminate proloculus is referred to this species, described from the Pliocene of Timms Point, California. Rare in sample 45.

(204) *Dentalina inflexa* (Reuss).

Nodosaria inflexa Reuss, 1865, Denkschr. d. k. Akad. Wiss. Wien, XXV, p. 131, pl. ii, fig. 1; Brady, 1884, p. 498, pl. lxii, fig. 9.

Two specimens from sample 45 having elongate pyriform chambers but lacking a connecting neck between the chambers appear to be referable to this species.

Genus *Vaginulina* d'Orbigny, 1826.

(205) *Vaginulina bassensis* Parr.

Vaginulina bassensis Parr, 1945, Proc. Roy. Soc. Victoria, **56**, N.S., pt. 2, p. 200, pl. 12, figs. 4*a*, *b*.

One specimen was found in sample 45, comparing well with specimens from the type locality on the shores of Bass Strait.

Genus *Marginulina* d'Orbigny, 1826.

(206) *Marginulina glabra* d'Orbigny.

Marginulina glabra d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 259, no. 6, Modèles no. 55.

Rare in sample 45 (2 specimens).

Genus *Amphicoryne* Schlumberger, 1881.

(207) *Amphicoryne scalaris* (Batsch).

Nautilus (*Orthoceras*) *scalaris* Batsch, 1791, Conchyl. Seesandes, No. 4, pl. ii, figs. 4*a*, *b*.
Nodosaria scalaris (Batsch). Brady, 1884, p. 510, pl. lxiii, figs. 28–31.

Eight specimens were found in sample 45, all megalospheric. The writer has followed Parr (1950) in referring this species to the genus *Amphicoryne*. One specimen had the final chamber separated from the earlier ones by the full length of the apertural neck, a condition rather similar to Brady's variety *separans*, in which, however, the final chamber commences at the base of the apertural neck of the penultimate chamber. Such forms occur, in the writer's experience, in any large series of specimens of *A. scalaris*, and therefore represent an individual modification rather than a geographical variety or subspecies, as suggested by Brady.

(208) *Amphicoryne hirsuta* (d'Orbigny).

Nodosaria hirsuta d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 252, no. 7.
Amphicoryne hirsuta (d'Orbigny). Parr, 1950, p. 328.

Two specimens were found in sample 45, both megalospheric.

Genus *Planularia* Defrance, 1824.

(208) *Planularia* sp. aff. *P. tricarinella* (Reuss).

Cristellaria tricarinella Reuss. Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 540, pl. lxviii, figs. 3 and 4.

One specimen from sample 45. This form has 17 chambers after the proloculus, and its dorsal edge is tricarinate as figured by Brady. It is not referable to *P. australis* Chapman (1941), which has fewer chambers and a rounded periphery.

Genus *Lenticulina* Lamarck, 1804.

(210) *Lenticulina iota* (Cushman).

Cristellaria iota Cushman, 1918 etc. (1923), U.S. Nat. Mus. Bull. **104**, pt. 4, p. 111, pl. xxix, fig. 2,pl. xxx, fig. 1.
Lenticulina iota (Cushman). Parr, 1950, p. 320.

Specimens are not uncommon in sample 45. As noted by Parr in the case of a Tasmanian specimen, the chambers are rather more recurved than in Cushman's figures.

(211) *Lenticulina peregrina* (Schwager).

Cristellaria peregrina Schwager, 1866, Novara-Exped., Geol. Theil., p. 245, pl. vii, fig. 89.
Lenticulina peregrina (Schwager). Parr, 1950, p. 321.

Three good examples were found in sample 45.

Subgenus *Robulus* Montfort, 1808.

(212) *Lenticulina* (*Robulus*) *altifrons* Parr.

Cristellaria acutiauricularis Brady (not of Fichtel and Moll), 1884, Rep. Voy. Chall., Zool. **9**, p. 543, pl. cxiv, fig. 17.
Lenticulina (*Robulus*) *altifrons* Parr, 1950, B.A.N.Z.A.R. Exped. Rep. V, pt. 6, p. 323, pl. xi, figs. 12*a*, *b*.

Five small specimens were found in sample 45. Brady's figured specimen was from Raine Island, and Parr records the species from off Tasmania.

(213) *Lenticulina* (*Robulus*) sp. cf. *cultratus* Montfort.

cf. *Robulus cultratus* Montfort 1808, Conchyl. Syst. **1**, p. 214, 54e genre ; Cushman and McCulloch, 1950, p. 296, pl. 37, figs. 7, 8.

Specimens close to those figured by Cushman and McCulloch from the Western Pacific were common in sample 45.

(214) *Lenticulina* (*Robulus*) *formosus* (Cushman).

Cristellaria formosa Cushman, 1918 etc. (1923), U.S. Nat. Mus. Bull. **104**, pt. 4, p. 110, pl. xxix, fig. 1, pl. xxx, fig. 6.

One large specimen of this well-marked species was found in sample 45.

(215) *Lenticulina* (*Robulus*) *vortex* (Fichtel and Moll).

Nautilus vortex Fichtel and Moll, 1803, Test. Micr., p. 33, pl. ii, figs. *d.i.*
Cristellaria vortex (Fichtel and Moll) of authors.
Robulus vortex (Fichtel and Moll). Cushman, 1932 etc. (1933), p. 6, pl. 2, figs. 1*a*, *b*.

One large specimen from sample 30, with strongly recurved, narrow chambers and limbate sutures is referred to this species.

Family POLYMORPHINIDAE.

Genus *Guttulina* d'Orbigny, 1839.

(216) *Guttulina regina* (Brady, Parker and Jones).

Polymorphina regina Brady, Parker and Jones, 1871, Trans. Linn. Soc. **27**, p. 241, pl. 41, figs. 32*a*, *b*.
Guttulina regina (Brady, Parker and Jones). Cushman and Ozawa, 1930, p. 34, pl. 6, figs. 1 and 2.

Two juvenile specimens from sample 45 are referable to this well-marked species, which is widely distributed in Australian waters.

Genus *Globulotuba* n. gen.

Test hyaline, perforate, circular in cross-section, " triloculine " in chamber arrangement, later chambers successively further removed from the base, aperture radiate with internal, free, entosolenian tube curved back toward but not directly connected with the aperture of the preceding chamber.

Genotype *Globulotuba entosoleniformis* n. sp.

This genus is erected for the reception of species having the general arrangement of *Globulina* d'Orbigny, but having a free internal entosolenian tube. It is basically different from *Siphoglobulina* Parr in that the " siphon " in the latter genus is within the wall and opens to the exterior at its proximal end. The existence of an entosolenian tube has been considered to be a character of generic value in the Lagenae (*vide* Parr, 1947), and has also been made the distinguishing feature of the polymorphine genus *Laryngosigma* Loeblich and Tappan.

(217) *Globulotuba entosoleniformis* n. sp.

(Plate IV, figs. 5*a*, *b*.)

Species with the characters of the genus.

Holotype from sample 45.

Dimensions of holotype : Length 0·36 mm., diameter 0·22 mm.

Rare in sample 45. The specimens show the feature described by Sidebottom in his Delos paper, in the absorption of the septal faces of earlier chambers, leaving the interior of the test as one clear space, the earlier chambers being marked only by their sutural junctions.

Genus *Pyrulina* d'Orbigny.

(218) *Pyrulina extensa* (Cushman).

Polymorphina longicollis Brady (not of Karrer), 1884, Rep. Voy. Chall., Zool. **9**, p. 572, pl. lxxiii, figs. 18 and 19.

P. extensa Cushman, 1910 etc. (1913), U.S. Nat. Mus. Bull. **71**, p. 90, pl. 41, figs. 1–3.

Pyrulina extensa (Cushman). Cushman and Ozawa, 1930, p. 53, pl. 12, figs. 5*a*–*c*.

One specimen of this deep-water species was found in sample 45.

Genus *Glandulina* d'Orbigny.

(219) *Glandulina laevigata* d'Orbigny.

Nodosaria (*Glandulina*) *laevigata* d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 252, no. 1, pl. 10, figs. 1–3.

This smooth form occurs in the samples of group 3 and is rather more common than other species of the genus. Both microspheric and megalospheric specimens were present.

(220) *Glandulina semistriata* n. sp.

(Plate IV, figs. 6*a*, *b*.)

Test fusiform, oral end bluntly rounded with a radiate aperture, apical end sharply pointed and surrounded by a very few small spines, surface finely striate except near the aperture, where it is smooth. The microspheric form (fig. 6) has 2 pairs of biserial chambers following the proloculus, then 2 uniserial, embracing chambers. The megalospheric form has a large proloculus followed by 3 uniserial embracing chambers.

Holotype from sample 23.

Dimensions of holotype : Length 0·34 mm., diameter 0·20 mm.

The megalospheric form of this species is very close to Batsch's fig. 2*c* of *Nautilus* (*Orthoceras*) *comatus* (1791, pl. 1), which has been identified by Cushman as *Pseudoglandulina glans* d'Orbigny, but the presence of the microspheric form establishes the species as a true *Glandulina*. Millett's figure of *Nodosaria* (*Glandulina*) *comata* (Batsch), (1898 etc. (1902), pl. xi, fig. 2), is also referable to this species.

(221) *Glandulina echinata* Millett.

Nodosaria (*Glandulina*) *echinata* Millett, 1898 etc. (1902), Journ. Roy. Micr. Soc., p. 512, pl. xi, figs. 4*a*, *b*.

Two specimens from sample 23 and one from 45 agree with Millett's figure in being ovate-fusiform with a short-lipped apertural neck and a development of short spines over the surface. An entosolenian tube is attached to the wall of the test from the aperture about half-way to the aboral end.

Millett does not indicate the nature of the early chambers in his species, but they are definitely biserial in the present specimens. While, therefore, the identification with Millett's species cannot be absolutely certain, it is considered to be likely, since the importance of the arrangement of the early chambers separating the nodosarian *Glandulinas* (= *Pseudoglandulina* Cushman) from the polymorphine (= *Glandulina* s. str.) was not then recognized.

Genus *Sigmomorphina* Cushman and Ozawa, 1928.

(222) *Sigmomorphina terquemiana* (Fornasini).

Polymorphina amygdaloides Reuss var. *terquemiana* Fornasini, 1902, Mem. Accad. Istut. Sci. Bologna, ser. 5, **9**, p. 72, text-fig. 25.

Sigmomorphina semitecta (Reuss) var. *terquemiana* (Fornasini). Cushman and Ozawa, 1930, p. 129, pl. 33, figs. 4, 5. pl. 34, figs. 2, 3, pl. 35, fig. 1 ; Cushman, 1932 etc. (1933), p. 40, pl. 9, figs. 6–9.

Two specimens from sample 45 are referable to this species, which has been recorded as Recent from the Mediterranean and the tropical Pacific. Since it has apparently been differentiated from *S. semitecta* s. str. since the Eocene, it appears best to treat it as a related but distinct species.

Genus *Laryngosigma* Loeblich and Tappan.

(223) *Laryngosigma williamsoni* (Terquem).

Polymorphina williamsoni Terquem, 1878, Mém. Soc. Géol. France, ser. 3, **1**, p. 37.

Sigmomorphina williamsoni (Terquem). Cushman and Ozawa, 1930, p. 138, pl. 38, figs. 3, 4.

Laryngosigma williamsoni (Terquem). Loeblich and Tappan, 1953, p. 84, pl. 16, fig. 1.

Specimens from sample 45 are somewhat smaller but otherwise closely similar to specimens from the coast of England with which they were compared. The entosolenian tube distinguishing this genus from *Sigmomorphina* is clearly evident in these specimens.

Superfamily BULIMINIDEA.

Family Buliminidae.

Subfamily Turrilininae.

Genus *Buliminella* Cushman, 1911.

(224) *Buliminella* sp. cf. *parallela* Cushman and Parker.

Bulimina elegantissima Millett (not of d'Orbigny), 1898 etc. (1900), Journ. Roy. Micr. Soc., p. 276, pl. 2, fig. 4.

cf. *Buliminella parallela* Cushman and Parker, 1931, Proc. U.S. Nat. Mus. **80**, art. 3, p. 13, pl. 3, figs. 15*a–c*.

A few specimens were found in most of the samples of groups 1, 2 and 3. They were of the type figured by Millett from the Malay Archipelago, questionably identified by Cushman and Parker as referable to their species *B. parallela*, the type of which was from the South Atlantic. The identification is probably correct, as there is sufficient variation in proportions and sutural depression in the Queensland specimens to include both figured specimens.

(225) *Buliminella latissima* n. sp.

(Plate IV, figs. 7*a, b, c*.)

cf. *Bulimina elegantissima* d'Orbigny var. *compressa* Millett (not *B. compressa* Bailey), 1898 etc. (1900), Journ. Roy. Micr. Soc., p. 277, pl. 2, fig. 5.

Test irregularly ovate in outline, compressed, of 2–3 whorls with 5–6 chambers in the last whorl, chambers narrow with slightly depressed, limbate, sinuate sutures, spiral suture distinct, sutural margin of chambers lobed, aperture semicircular at the base of the flattened semicircular apertural face of the last chamber, with radiating striae.

Holotype from sample 45.

Dimensions of holotype: Length 0·26 mm., breadth 0·16 mm., breadth 0·16 mm., thickness 0·11 mm.

Only two specimens of this form were found, but its compressed form and proportions are so distinctive that it was considered worthy of description as new. Millett's var. *compressa* has many points of resemblance, the main difference being the more regular shape of the chambers and the absence of sutural lobing. Cushman and Parker (1947) have placed Millett's form questionably in the synonymy of *B. parallela*, but the compressed form is a distinctive character, unusual in this genus, which justifies separation. The present specimens would have been referred provisionally to Millett's variety had the name been available for use. In the circumstances it appears best to describe it as a new species.

(226) *Buliminella milletti* Cushman.

Buliminella milletti Cushman, 1933, Contr. Cushman Lab. Foram. Res. **9**, pt. 4, p. 78, pl. 8, figs. 5, 6.

Rare in the samples of groups 1, 2 and 3. The species is recorded from many localities in the Indo-Pacific area and also from the West Indies.

(227) *Buliminella spicata* Cushman and Parker.

Buliminella madagascariensis (d'Orbigny) var. *spicata* Cushman and Parker (in Cushman), 1932 etc. (1942), U.S. Nat. Mus. Bull. **161**, pt. 3, p. 8, pl. 3, figs. 5, 6.

Frequent in samples 26 and 45. As this form has a similar geological range and occurs in the same geographical areas as *B. madagascariensis* s. str., it cannot be regarded as a subspecies, and is therefore here considered as a related but distinct species.

Genus *Buliminoides* Cushman, 1911.

(228) *Buliminoides williamsonianus* (Brady).

Bulimina williamsoniana Brady, 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, p. 56; 1884, p. 408, pl. li, figs. 16, 17.
Buliminoides williamsonianus (Brady). Cushman, 1910 etc. (1911), U.S. Nat. Mus. Bull. **71**, pt. 2, p. 90, text-fig. 144.

This species is well distributed and common in the warmer waters of the Australian region, and is recorded by Parr (1945) from Bass Strait. Occasional in the samples of groups 1, 2 and 3.

Genus *Ungulatella* Cushman, 1931.

(229) *Ungulatella pacifica* Cushman.

(Plate IV, fig. 8.)

Ungulatella pacifica Cushman 1931, Contrib. Cushman Lab. Foram. Res. **7**, p. 82, pl. 10, figs. 11, 12.

Four specimens of this rare species were found in samples 29 and 30 from Jukes Reef, Outer Barrier. The species was described from the island of Rangiroa in the South Pacific, and it does not appear to have been recorded since then.

Subfamily BULIMININAE.

Genus *Bulimina* d'Orbigny, 1826.

(230) *Bulimina barbata* Cushman.

Bulimina barbata Cushman, 1927, Scripps Inst. Oceanog. Bull., Tech. ser. **1**, no. 10, p. 151, pl. 2, fig. 11.

Specimens were common in sample 45. The species was described from the Western Pacific and has been recorded by Cushman from the Philippines.

(231) *Bulimina marginata* d'Orbigny.

Bulimina marginata d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 269, no. 4, pl. 12, figs. 10–12.

This widely-distributed species was occasionally found in the samples of group 3 and was common in sample 45.

(232) *Bulimina rostrata* Brady.

Bulimina rostrata Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 408, pl. li, figs. 14, 15.

Two specimens were found in sample 26. This species has a general Pacific distribution.

(233) *Bulimina oblonga* n. sp.

(Plate IV, figs. 9*a*, *b*, *c*.)

Test short, thick, with both ends bluntly rounded, slightly increasing in width toward the oral end, in 2–3 whorls with 3 chambers to a whorl, sutures very slightly depressed and limbate, about 12 weak costae developed in the earlier part of the test, extending about half-way toward the oral end. Aperture loop-shaped, almost axial and commencing at the suture between the last 2 chambers.

Holotype from sample 45.

Dimensions of holotype : Length 0·25 mm., diameter 0·16 mm.

Three specimens only were found, but the characters appear distinct enough for it to be described as new. It does not appear to be closely related to any described form.

Genus *Globobulimina* Cushman, 1927, emend. Höglund 1947.

(234) *Globobulimina australiensis* n. sp.

(Plate IV, figs. 10*a*, *b*, *c*.)

Test fusiform, both ends bluntly rounded, brownish in colour, wall transparent in later chambers, conspicuously perforate, chambers distinct, slightly inflated, the last extending about two-thirds of the length of the test proximally, chambers 3 to a whorl in the later part of the test. Aperture open, virguline, turning inwards without any collar, toothplate projecting slightly if at all, rolled into two-thirds of a circle, free edge smooth.

Holotype from sample 45, where it is fairly common.

Dimensions of holotype : Length 0·80 mm., diameter 0·42 mm.

This species is very close to that described by Höglund (1947) as *Globobulimina* sp. " *b* ", but the chambers are rather more inflated in adult specimens and the test wall is thick and translucent in the earlier chambers, transparent in the last one or two. Höglund makes a point of the opacity of the wall in his specimens, but it is doubtful whether this can be considered to be a specific feature. All the specimens found were apparently megalospheric.

Genus *Virgulina* d'Orbigny, 1826.

(235) *Virgulina complanata* Egger.

Virgulina schreibersiana Czjzek, var. *complanata* Egger, 1893, Abhandl. kön. bay. Akad. Wiss. Munchen, cl. ii, 18, p. 292, pl. 8, figs. 91, 92.
V. complanata Egger. Cushman, 1937*b*, p. 26, pl. 4, figs. 13–17.

A compressed biserial form which occurs occasionally in the samples of all groups is referred to this species, which was described from off Western Australia and has been recorded from the Pacific islands, the Antarctic and south-eastern Australia.

(236) *Virgulina pauciloculata* Brady.

Virgulina pauciloculata Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 414, pl. lii, figs. 4 and 5.

This species, distinguished by its elongate chambers extending proximally, is not uncommon in the samples of groups 3 and 4. It has a wide Pacific distribution.

Subfamily Delosininae.

Genus *Delosina* Wiesner, 1931.

(237) *Delosina complexa* (Sidebottom).

Polymorphina complexa Sidebottom, 1904, etc. (1907), Mem. Manchester Lit. Phil. Soc. LI, no. 9, p. 16, pl. iv, figs. 1–3; 1918, p. 145, pl. v, figs. 6, 7.
Delosina complexa (Sidebottom). Earland, 1934, p. 127, pl. v, fig. 16.

Two characteristic specimens were found in sample 36. The species has been recorded from the coast of New South Wales and from the Antarctic.

Subfamily Reussellininae.

Genus *Reussella* Galloway, 1933.

(238) *Reussella spinulosa* (Reuss).

Verneuilina spinulosa Reuss, 1850, Denkschr. Akad. Wiss. Wien, **1**, p. 374, pl. 47, fig. 12.
Reussella spinulosa (Reuss). Galloway, 1933, p. 360, pl. 33, fig. 4.

Fairly common in all groups. The specimens are closely comparable with topotype material from Nussdorf, being broadly triangular in side view with short blunt spines on the basal edge of each chamber.

(239) *Reussella spinosissima* (Costa).

Verneuilina spinossisima Costa, 1856, Atti Acad. Pont. **7**, pt. 2, p. 263, pl. 23, figs. 5*a–c*.
Reussella spinosissima (Costa). Cushman, 1937, p. 20; 1945, p. 38, pl. 7, figs. 1–3.

A somewhat elongate form, with blunt spines at the basal angles of the chambers and a rather large, triangular aperture is referred to this species, which was described from the Pliocene of Italy and is recorded in the Recent state from the Mediterranean and the Red Sea. Rare in the samples of groups 1, 2 and 3.

Genus *Chrysalidinella* Schubert, 1907.

(240) *Chrysalidinella dimorpha* (Brady).

Chrysalidina dimorpha Brady, 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, p. 24; 1884, p. 388, pl. xlvi, figs. 20, 21; Millett, 1898 (1900), p. 12, pl. 1, fig. 14; Heron-Allen and Earland, 1914 etc. (1915), p. 632, pl. xlvii, figs. 29–31.
Chrysalidinella dimorpha (Brady). Schubert, 1907, p. 243.
C. earlandi Cushman, 1945, p. 53, pl. 8, fig. 23.

This species is fairly common in the samples of groups 1, 2 and 3. Many of the specimens are of the elongate parallel-sided form figured by Heron-Allen and Earland (1915) and re-named by Cushman as *C. earlandi*. However, considerable variation in proportions is shown both in the present material and in a large series of specimens collected by the author from the coast near Dar-es-Salaam, East Africa. Both typical *dimorpha* and *earlandi* occur in the same material together with other variations in shape, and the separation of the latter form does not appear to be justified.

Genus *Mimosina* Millett, 1900.

(241) *Mimosina affinis* Millett.

Mimosina affinis Millett, 1898 etc. (1900), Journ. Roy. Micr. Soc., p. 548, pl. iv, fig. 11 ; Heron-Allen and Earland, 1914 etc. (1915), p. 650 ; Cushman, 1945, p. 43, pl. 7, figs. 15, 16.

This species was not uncommon in the samples of group 3. Specimens were close to Millett's figures in general form and surface characteristics, but the sutural aperture was in all cases a simple curved slit, not cribrate. However, Millett describes the aperture as " a slit, usually cribrate ", so that this feature is apparently variable.

(242) *Mimosina rimosa* Heron-Allen and Earland.

(Plate IV, fig. 11.)

Mimosina rimosa Heron-Allen and Earland, 1914 etc. (1915), Trans. Zool. Soc. London, **20**, p. 650, pl. l, figs. 5–11.

Typical specimens were found in the samples of group 3. This species does not appear to have been recorded since its original description from the Kerimba Archipelago.

(243) *Mimosina echinata* Heron-Allen and Earland.

Mimosina echinata Heron-Allen and Earland, 1914 etc. (1915), Trans. Zool. Soc. London, **20**, p. 651, pl. 50, figs. 12–18 ; Sidebottom; 1918, p. 128 ; Cushman, 1945, p. 44, pl. 7, figs. 20–22.

Typical specimens were not uncommon in the samples of groups 3 and 4. The species is recorded by Sidebottom from off New South Wales.

Genus *Trimosina* Cushman, 1927.

(244) *Trimosina milletti* Cushman, subsp. *multispinata*, n. subsp.

(Plate IV, fig. 12.)

This species differs from *T. milletti milletti* in the development of a fringe of short spines on the lower margin of all the chambers. except the last 2 or 3. In the early part of the test the septation is largely obscured by this spinous development. The apertures are variable, that at the junction of the last and penultimate chambers varying from slit-like to arched, and the supplementary aperture in the distal face rounded to triangular. These differences, while constant, do not appear to justify specific distinction, and as the typical form does not occur in this material, the spinous variation is treated as a geographical subspecies.

Holotype from sample 44. Distribution generally in group 3, rare.

Dimensions of holotype : Length 0·31 mm., greatest diameter 0·24 mm.

Subfamily UVIGERININAE.

Genus *Uvigerina* d'Orbigny, 1826.

(245) *Uvigerina proboscidea* Schwager.

Uvigerina proboscidea Schwager, 1866, Novara-Exped., Geol. Theil. II, p. 250, pl. 7, fig. 96.
U. proboscidea Schwager. Cushman and Todd, 1941, p. 73, pl. 17, fig. 9, pl. 19, figs. 3–9 ; Parr, 1950, p. 340.

A few specimens were found in most of the samples of groups 1, 2 and 3.

(246) *Uvigerina porrecta* Brady.

Uvigerina porrecta Brady, 1879 etc., Quart. Journ Micr. Sci. XIX, N.S., p. 60, pl. viii, figs. 15, 16 ; 1884, p. 577, pl. lxxiv, figs. 22, 23.

Rare in samples of group 3, rather more common in sample 45.

Genus *Siphouvigerina* Parr, 1950.

(247) *Siphouvigerina fimbriata* (Sidebottom).

Uvigerina porrecta Brady, var. *fimbriata* Sidebottom, 1918, Journ. Roy. Micr. Soc. for 1918, p. 147, pl. v, fig. 23.

Siphouvigerina fimbriata (Sidebottom). Parr, 1950, p. 342, pl. xii, fig. 22.

This beautiful little species was found to be rare in samples 23, 24 and 45. Its recorded range is from off Java to the colder waters east of Tasmania.

Genus *Siphogenerina* Schlumberger, 1883.

(248) *Siphogenerina striata curta* Cushman.

Sagrina striata Brady, 1884 (not of Schwager), p. 584, pl. lxxv, figs. 25, 26.

Siphogenerina striata (Schwager), var. *curta* Cushman, 1926, Proc. U.S. Nat. Mus. **67**, art. 25, p. 8, pl. 2, fig. 5, pl. 5, figs. 5, 6.

Fairly common in samples of groups 1, 2 and 3.

(249) *Siphogenerina virgula* (Brady).

(Plate IV, figs. 13*a*, *b*, *c*.)

Sagrina virgula Brady, 1879 etc., Quart. Journ. Micr. Sci. XIX, N.S., p. 61, pl. viii, figs. 19–21 ; 1884, p. 583, pl. lxxvi, figs. 4–7 (not 8–10).

S. australiensis Goddard and Jensen, 1907, p. 294, pl. 6, figs. 3*a–c*.

Siphogenerina virgula (Brady). Cushman, 1926, p. 14, pl. 2, figs. 7, 8, pl. 4, figs. 8, 9 (synonymy).

Rectobolivina virgula (Brady). Hofker, 1951, p. 93, text-fig. 52.

This species occurs in three forms in the present material. The megalospheric form has a proloculus nearly as big as the following uniserial chamber, and appears to be the rarest of the three forms. A microspheric form has a bolivine series of from 4 to 6 chambers, usually set at an angle to the later axis of growth, and another microspheric form has a reduced biserial portion of 2–3 chambers, practically circular in section and in line with the later axis. This latter form is by far the commonest and is met with in most of the samples.

The author has topotype material of Goddard and Jensen's *Sagrina australiensis* from the collection of the late W. J. Parr. The specimens are all of the microspheric form with reduced biserial portion referred to above, and lack the development of long spines pointing proximally from the apertural lip of each uniserial chamber. This is a common occurrence in shallow-water material and can be ascribed to erosion, as closely similar specimens from other shallow deposits show the full development of these delicate spines In the author's opinion, *S. australiensis* as described by Goddard and Jensen is no more than a somewhat eroded microspheric specimen of Brady's *S. virgula*.

The present material bears out Hofker's statement that the early portion of the test is biserial rather than uvigerine, as previously accepted. However, Bandy (1952) has shown that the type species of *Siphogenerina*, *S. raphanus* (Parker and Jones), includes forms with either biserial or triserial early chambers. so that *S. virgula* cannot be separated on this character. *Rectobolivina* is not available for this species, since by definition it includes only compressed forms such as the type, *R. bifrons.*

The feature which appears to separate *S. virgula* from other Siphogenerinae is the absence of any connecting structure (siphon or toothplate) between successive apertures. The rudimentary toothplate observed by Hofker, which the present author has been unable to discern, hardly takes the place of the elaborate and well-developed structures seen in other species. It rather suggests the small tooth found in the genus *Siphonodosaria*, and it may be that the present species represents a stage in evolution between *Siphogenerina* and *Siphonodosaria* ; in fact, the megalospheric form in the absence of the others could well be referred to the latter genus.

Considering the present state of uncertainty in the classification of the species once included in " *Sagrina* ", it is perhaps best to retain this species in *Siphogenerina* pending further revision.

Genus *Trifarina* Cushman, 1923.

(250) *Trifarina bradyi* Cushman.

Rhabdogonium tricarinatum Brady, 1884 (not *Vaginulina tricarinata* d'Orbigny), p. 525, pl. lxvii, figs. 1–3.
Trifarina bradyi Cushman, 1918 etc. (1923), p. 99, pl. xxii, figs. 3–9.

Typical specimens were found in sample 45.

Subfamily Gümbelininae.

Genus *Gümbelitria* Cushman, 1933.

(251) *Gümbelitria vivans* Cushman.

(Plate IV, fig. 14.)

Verneuilina pygmaea Millett, 1898 etc. (1900) (not of Egger), p. 11, pl. 1, figs. 13*a*, *b*.
Gümbelitria ? vivans Cushman, 1934, Contrib. Cushman Lab. Foram. Res. **10**, pt. 4, p. 105, pl. 13, figs. 9, 10.

This rare species was not uncommon in the samples of group 3 and in sample 45. The specimens were all triserial throughout, none showing the irregular addition of the later chambers noted by Cushman. The first record of this form appears to be that of Millett (loc. cit) who considered it to be a hyaline isomorph of *Verneuilina pygmaea* Egger, and recorded it as " scattered over the region ". His Malay Archipelago material was mostly from shallow water, Cushman's specimens were from off New Guinea in 129 fathoms, and the present specimens are from 600 metres and from shallow-water dredgings.

As the characters of the species are substantially those of the Upper Cretaceous and Eocene genus *Gümbelitria*, it is here referred accordingly, though the absence of records of the genus from the later Tertiary suggests that there may not be a direct phylogenetic relationship, and that the Recent species may be a parallel development deriving from some other triserial form.

Subfamily Plectofrondiculariinae.

Genus *Bolivinella* Cushman, 1927.

(252) *Bolivinella elegans* Parr.

Textularia folium Parker and Jones. Brady, 1884 (pars.), pl. xlii, figs. 3–5, (not 1, 2).
Bolivinella elegans Parr, 1932, Proc. Roy. Soc. Victoria, **44**, n.s., pt. II, p. 224.

B. folia (Parker and Jones). Cushman, 1929 (not of Parker and Jones), p. 29, pl. 5, figs. 1, 2; 1932 etc. (1942), p. 3, pl. 2, figs. 1–4, 6.

B. folia (Parker and Jones), var. *ornata* Cushman. Cushman, 1932 etc. (1942) (not of Cushman, 1929), p. 5, pl. 2, figs. 5, 8.

Considerable confusion has arisen between *Bolivinella folium* (Parker and Jones) and *B. elegans* Parr. It was shown by Parr (1932) that *B. folium* (*typica*) is a southern Australian species, characterized by broadly limbate sutures broken by fine diagonal striae which converge toward the distal end of the test, giving the effect of fine beading. This is the form described by Cushman (1929) as *B. folia* var. *ornata*, a name which should be relegated to the synonymy of *B. folium*. *B. elegans* is a species of the warmer waters of the Indo-Pacific, and is characterized by raised, thin ridge-like sutures without beading.

Cushman (1942) records a single specimen of " *B. folia* var. *ornata* " from Levuka, Fiji, but illustrates two different specimens (figs. 5 and 8) which do not show the ornament of the southern Australian species, and in general fall within the rather wide limits of variation of *B. elegans*. This record is considered to be of doubtful authenticity.

B. elegans is not uncommon in sample 45.

Subfamily BOLIVININAE.

Genus *Bolivina* d'Orbigny, 1839.

(253) *Bolivina abbreviata* Heron-Allen and Earland.

Bolivina limbata Brady, var. *abbreviata* Heron-Allen and Earland, 1924, Journ. Linn. Soc., Zool. **35**, p. 622, pl. 36, figs. 25–27.

B. abbreviata Heron-Allen and Earland. Cushman, 1937, p. 143, pl. 18, figs. 24, 25.

Rare in the samples of groups 1, 2 and 3. Records are all from the Pacific.

(254) *Bolivina alata* Seguenza subsp. *fimbriata*, n. subsp.

(Plate V, figs. 1*a*, *b*.)

This subspecies differs from *B. alata alata* in the keel being blunt and fimbriate, due to a row of tubules within it, rather than thin and imperforate as in the typical form. Otherwise the characters are those of the typical species, which was not found in the material.

Holotype from sample 45, where it was fairly frequent.

Dimensions of holotype: Length 0·34 mm., breadth 0·17 mm., thickness 0·06 mm.

(255) *Bolivina compacta* Sidebottom.

Bolivina robusta Brady, var. *compacta* Sidebottom 1904 etc. (1905), Mem. Proc. Manchester Lit. Phil. Soc. **49**, no. 5, p. 15, pl. 3. fig. 7.

B. compacta Sidebottom. Cushman 1937, p. 135, pl. 17, figs. 22–24 (synonymy).

Rare in the samples of groups 1, 2 and 3.

(256) *Bolivina hantkeniana* Brady.

Bolivina hantkeniana Brady 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, p. 58; 1884, p. 424, pl. lii, figs. 16–18; Cushman, 1937, p. 127, pl. 16, figs. 18–20 (synonymy).

Rare in sample 45.

(257) *Bolivina quadrilatera* (Schwager).

Textularia quadrilatera Schwager, 1866, Novara-Exped., Geol. Theil. II, p. 253, pl. 7, fig. 10.
Bolivina quadrilatera (Schwager). Wright, 1891, p. 475 ; Hofker, 1951*a*. p. 102 *et seq.*
Bolivinita quadrilatera (Schwager). Cushman, 1927, p. 90; 1932 etc. (1942), p. 2, pl. 1.

As pointed out by Hofker, this species has all the characteristics of a typical *Bolivina*, and is not congeneric with the Cretaceous " *Bolivinita* " *eleyi*. Rare in sample 45.

(258) *Bolivina rhomboidalis* (Millett).

Textularia rhomboidalis Millett, 1898 etc. (1899), Journ. Roy. Micr. Soc., p. 559, pl. 7, fig. 4.
Bolivina rhomboidalis (Millett). Cushman, 1922, p. 28 ; 1937, p. 138, pl. 18, fig. 7 (synonymy).

Occasional in samples of groups 1, 2 and 3.

(259) *Bolivina subtenuis* Cushman.

Bolivina tenuis Brady (not of Marsson) 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, p. 57; 1884, p. 419, pl. lii, fig. 29.
B. subtenuis Cushman, 1936, p. 57, pl. 8, fig. 10 ; Collins, 1953, p. 101, pl. 1, fig. 7.

Most of the records of this species are from the Fiji and Samoan islands, but it has been recorded by the author from Pleistocene deposits in western Victoria and is present in " Challenger " Stn. 185 material from Raine Island. Rare in sample 45.

(260) *Bolivina tortuosa* Brady.

Bolivina tortuosa Brady, 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, p. 57; 1884, p. 420, pl. lii, figs. 31, 32 ; Cushman, 1937, p. 133, pl. 17, figs. 11–19 (synonymy).

This typical Indo-Pacific species was common in the finer fractions of most of the samples.

(261) *Bolivina zanzibarica* Cushman.

Bolivina zanzibarica Cushman, 1936, Sp. Publ. no. 6, Cushman Lab. Foram. Research, p. 58, pl. 8, figs. 12*a*, *b*.

This small species will probably be found to have an Indo-Pacific range similar to other East African species which occur in the Australian region. Rare in samples 24.

Genus *Loxostomum* Ehrenberg, 1854.

(262) *Loxostomum convallarium* (Millett).

(Plate V, fig. 2.)

Bolivina convallaria Millett, 1898 etc. (1900), Journ. Roy. Micr. Soc., p. 544, pl. lv, figs. 6*a*, *b*.
Loxostoma convallarium (Millett). Cushman, 1937, p. 191, pl. 22, figs. 11–13.

Hofker (1951) has referred this species to the genus *Bitubulogenerina* Howe, stating that the early chambers are triserial. No specimens with triserial early chambers were found in the present material, all being biserial throughout, with a tendency toward uniseriality in the later chambers. The specimens are very close to Millett's original figures, which show smooth rounded chambers deeply undercut and crenulate at the base, features which are not apparent in Hofker's figures of his specimens. The shell wall is smooth, polished and hyaline with scattered pores, not opaque as stated by Hofker; nor do the chamber walls present nodular outgrowths as his figures indicate.

It is therefore considered that the species is correctly placed in the genus *Loxostomum*. Specimens were not infrequent in the samples of groups 2 and 3.

(263) *Loxostomum strigosum* (Brady).

Bolivina lobata Brady, var. *strigosa* Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 425, pl. cxiii, fig. 7.
Loxostoma strigosum (Brady). Cushman, 1937, p. 189, pl. 22, fig. 1 (synonymy).

Two typical specimens of this rarely-recorded species were found in sample 45.

(264) *Loxostomum mayori* (Cushman).

Bolivina mayori Cushman, 1922, Publ. 311, Carnegie Inst. Washington, p. 27, pl. 3, figs. 5 and 6.
Loxostoma mayori (Cushman). Cushman, 1937, p. 195, pl. 22, figs. 16–21 (synonymy).

Rare in samples 32 and 45. It was described from the Tortugas and is widely recorded in the Pacific.

(265) *Loxostomum limbatum* (Brady).

Bolivina limbata Brady, 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, p. 27; 1884, p 419, pl. lii, figs. 26–28.
Loxostoma limbatum (Brady). Cushman, 1937, p. 186, pl. 21, figs. 36–39.

This widely-distributed species was common in most of the samples.

Genus *Bifarina* Parker and Jones, 1872.

(266) *Bifarina elongata* Millett.

(Plate V, fig. 3.)

Bifarina elongata Millett, 1898 etc. (1900), Journ. Roy. Micr. Soc., p. 281, pl. 2, fig. 15.

Two specimens from samples 38 and 45 appear to be referable to this species, which has apparently not been recorded since its original description. Its distinctive features are the triangular later chambers with spinous projections, the ornamentation with longitudinal rows of puncta, and the slit-like terminal aperture which takes up practically all of the distal end of the last chamber. The specimens are more regular in form than Millett's figured specimen.

(267) *Bifarina queenslandica* n. sp.

(Plate V, figs. 4*a*, *b*.)

Test elongate, irregularly tapering, about 5 times the breadth in length, compressed oval in cross-section, chambers biserial in early stages with the axis of growth somewhat curved or twisting, becoming straight in later portion, last two or three chambers uniserial. Periphery rounded, slightly lobulate, sutures limbate and slightly depressed, chamber wall coarsely punctate giving a reticulate and semi-opaque appearance. Aperture terminal, within a roughly oval depression into which on one side projects a tooth-like extension of the chamber wall. The actual aperture is obscure, apparently slit-like. In broken specimens the apertural foramen is seen to be an oval hole surrounded by a raised rim or low collar, but there is no indication of any connecting structure between successive apertures.

Holotype from sample 11.

Dimensions of holotype : Length 0·57 mm., breadth 0·16 mm., thickness 0·11 mm.

Rare in the samples of groups 1, 2 and 3, seldom more than one or two specimens in a sample. This species does not seem to be closely related to any described form.

Genus *Rectobolivina* Cushman, 1927.

(268) *Rectobolivina bifrons* (Brady).

Sagrina bifrons Brady, 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, p. 64; 1884, p. 582, pl. lxxii, figs. 18–20.
Rectobolivina bifrons (Brady). Cushman, 1927*a*, p. 68, pl. 14, fig. 11; 1937, p. 204, pl. 23, figs. 13 and 14 (synonymy).

Two specimens were found in sample 45.

Family CASSIDULINIDAE.

Genus *Cassidulina* d'Orbigny, 1826.

(269) *Cassidulina elongata* Sidebottom.

Cassidulina bradyi Norman, var. *elongata* Sidebottom, 1904 etc. (1905), Mem. Proc. Manchester Lit. Phil. Soc. **49**, no. 5, p. 17, pl. 3, fig. 11; Heron-Allen and Earland, 1914 etc. (1915), p. 653, pl. 1, fig. 20.

One specimen of this widely-distributed but seldom recorded form was found in sample 30. It appears to have as wide a range of occurrence as *C. bradyi s. str.*, from the NW. Atlantic to the Indo-Pacific, so that it is best considered as a separate species.

(270) *Cassidulina laevigata* d'Orbigny.

Cassidulina laevigata d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 282, pl. xv, figs. 4 and 5; Brady, 1884, p. 428, pl. liv, figs. 1–3.

Four specimens of this wide-ranging species were found in sample 32.

Genus *Orthoplecta* Brady, 1884.

(271) *Orthoplecta clavata* Brady.

Cassidulina (*Orthoplecta*) *clavata* Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 432, pl. cxiii, fig. 9.

One specimen was found in sample 32. The species was described from the Admiralty Islands.

Family CHILOSTOMELLIDAE.

Genus *Chilostomella* Reuss, 1850.

(272) *Chilostomella oolina* Schwager.

Chilostomella oolina Schwager, 1878, Bull. Com. Geol. Ital. **9**, p. 527, pl. 1, fig. 16; Cushman, 1926*a*, p. 74, pl. 11, figs. 3–10.

Three small, elongate, thin-walled specimens from sample 45 are referred to this species.

Genus *Seabrookia* Brady, 1890.

(273) *Seabrookia pellucida* Brady.

Seabrookia pellucida Brady, 1890, Journ. Roy. Micr. Soc., p. 567, text-fig. 60, 1*a–c*; Millett, 1898 etc. (1901), p. 3, pl. 1, figs. 4*a–d*; Chapman, 1910, p. 406; Heron-Allen and Earland, 1922, p. 141; Parr, 1950, p. 346.

Not uncommon in sample 45. Occasional specimens were found in the samples of group 3.

Genus *Pullenia* Parker and Jones, 1862.

(274) *Pullenia quinqueloba* (Reuss).

Nonionina quinqueloba Reuss, 1851, Zeitschr. deutsch. Geol. Ges. **3**, p. 71, pl. 5, fig. 31.
Pullenia quinqueloba (Reuss). Brady, 1882, xi, p. 712; Cushman and Todd, 1943, p. 10, pl. 2, fig. 5; pl. 3, fig. 8 (synonymy).

Three specimens were found in sample 45. The two smaller ones had 5 chambers in the final whorl, the larger had 4 but they are considered to be conspecific.

Genus *Sphaeroidina* d'Orbigny, 1826.

(275) *Sphaeroidina bulloides* d'Orbigny.

Sphaeroidina bulloides d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 267, no. 1; Brady, 1884, p. 620, pl. lxxxiv, figs. 1 to 5 (not 6, 7).

Common in sample 45, occasional in the samples of group 3.

Genus *Nonionella* Cushman, 1926.

(276) *Nonionella pulchella* Hada.

Nonionella pulchella Hada, 1931, Tohoku Imp. Univ. Sci. Repts., ser. 4, Biol. **6**, p. 120, Text-fig. 79.

Rare in sample 24 (2 specimens). This species was described from Mutsu Bay, Japan.

Genus *Nonion* Montfort, 1808.

(277) *Nonion subturgidus* (Cushman).

Nonionina subturgida Cushman, 1924, Publ. 342, Carnegie Inst. Washington, p. 47, pl. 16, fig. 2.
Nonion subturgidum (Cushman). Cushman, 1932 etc. (1933), p. 43, pl. 10, figs. 4–7.

Not uncommon in the samples of group 3, many specimens in sample 27.

(278) *Nonion* cf. *depressulus* (Walker and Jacob).

cf. *Nautilus depressulus* Walker and Jacob, 1798, in Adams' Essays (Kanmacher's Edn.) p. 64, pl. 14, fig. 33.
cf. *Nonion depressulus* (Walker and Jacob). Cushman, 1939, p. 20, pl. 5, figs. 22–25.

Occasional specimens in the samples of groups 1, 2 and 3 are doubtfully referred to this species.

(279) *Nonion scapha* (Fichtel and Moll).

Nautilus scapha Fichtel and Moll, 1798, Test. Micr., p. 105, pl. 19, figs. *d–f*.
Nonion scaphum (Fichtel and Moll). Cushman, 1939, p. 20, pl. 5, figs. 18–21 (synonymy).

Rare, one specimen being found in sample 9.

Superfamily ROTALIDEA.

Family SPIRILLINIDAE.

Subfamily SPIRILLININAE.

Genus *Spirillina* Ehrenberg, 1843.

(280) *Spirillina vivipara* Ehrenberg.

Spirillina vivipara Ehrenberg, 1843, K. Akad. Wiss. Berlin, Physik Abh., p. 442, pl. iii, sec. 7, fig. 41.

This widely-distributed species is frequent in the finer fractions of most of the samples.

(281) *Spirillina limbata* Brady.

Spirillina limbata Brady, 1879 etc., Quart. Journ. Micr. Sci. XIX, N.S., p. 278, pl. viii, figs. 6*a*, *b* ; 1884, p. 632, pl. lxxxv, figs. 18–21 ; Parr, 1950, p. 348.

Rare in sample 29 (1 specimen).

(282) *Spirillina decorata* Brady.

Spirillina decorata Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 632, pl. lxxxv, figs. 22–25.

Rare in sample 45 (1 specimen).

(283) *Spirillina inaequalis* Brady.

Spirillina inaequalis Brady, 1879, Quart. Journ. Micr. Sci. XIX, p. 278, pl. viii, figs. 25*a*, *b* ; 1884, p. 631, pl. lxxxv, figs. 8–11.

Occasionally found in samples of group 3 with *S. vivipara*, but less common than that species.

Genus *Planispirillina* Bermudez, 1952.

(284) *Planispirillina denticulata* (Brady).

Spirillina limbata Brady, var. *denticulata* Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 632, pl. lxxxv, fig. 17.
S. denticulogranulata Chapman, 1909, p. 133, pl. x, fig. 6.
S. denticulata Brady. Ovey, 1947, pp. 17, 18 ; Parr, 1950, p. 351.

The recorded range of this species is from Raine Island to Bass Strait. It was found to be rare in the samples of group 3.

Genus *Mychostomina* Berthelin, 1881.

(285) *Mychostomina revertens* (Rhumbler).

Spirillina vivipara Ehrenberg, var. *revertens* Rhumbler, 1906, Zool. Jahrb. Abt. Syst. Geol. Biol **24**, p. 32, pl. 2, figs. 8–10.
Mychostomina revertens (Rhumbler). Galloway, 1933, p. 88, pl. 7, figs. 6, 7 ; Bermudez, 1952, p. 27, pl. 1, figs. 4–6.

Occasional specimens were found in the finer fractions of samples of all groups

Subfamily PATELLINAE.

This subfamily is usually considered as containing four genera, *Patellina*, *Patellinella*, *Annulopatellina* and *Patellinoides*. Hofker (1951) has recently combined three of them (*Patellina*, *Patellinella* and *Patellinoides*) in a new genus *Discobolivina*, which is obviously invalid, since the only name available for a combination of these three genera is that of the first-described, *Patellina*. His reasons for this combination are based on the morphology of the aperture and associated structures and on the pore system, and he considers that the many records which refer to an undivided spiral commencement in these genera are erroneous (p. 422, loc. cit.). This contention can scarcely be upheld against the weight of contrary evidence, particularly the detailed researches of Myers (1935) in the case of *Patellina*.

In the present collections there are specimens of *Patellina corrugata* Williamson in which the earlier whorls are clearly undivided and spirilline. The author can, moreover, vouch for the occurrence of an undivided spiral commencement in the Tertiary species described as *Patellinella annectens* Parr and Collins, 1930. The genus *Patellinoides*, described fron the Antarctic by Heron-Allen and Earland (1934), is characterized by undivided early whorls, as shown clearly in the figures and also described.

In contrast, the type species of the genus *Patellinella* (*P. inconspicua* Brady) which is common in the shore sands of the region from which it was described, Bass Strait, is either pseudobiserial from the beginning or in some specimens commences with a short trochospiral series of 2 or 3 chambers. In such specimens the early chambers may show a brown coloration similar to that found in *Discorbis* and other rotaline genera. The four species of " Discobolivina " illustrated by Hofker (loc. cit.) also start with a short trochospiral series.

The investigations of Wood (1948) on the structure of the foraminiferal test show that *Spirillina*, *Patellina* and *Patellinoides* tend to have the test made up of a single crystal of calcite, whereas *Patellinella* is shown to have a radial wall structure similar to that of most other Rotalidae.

These considerations suggest that two distinct lineages exist in this subfamily. *Patellina* and *Patellinoides* are characterized by having an undivided spiral commencement and single-crystal wall structure, suggesting that these genera have evolved from a spirilline ancestor, while *Patellinella* has a trochospiral early series and radial wall structure, suggesting discorbine ancestry.

It follows that the pseudobiserial growth-plan of the later chambers in the three patellinid genera, actually a trochospiral coil with the chambers added at 180° intervals, as shown by the alternating slant of the loop-shaped aperture, is a case of convergence, producing similar apertural structures in genera which are not closely related.

The tertiary species *Patellinella annectens* should probably be referred to the genus *Patellinoides* on account of its spirilline commencement. The position of this species and of the genus *Annulopatellina* Parr and Collins requires detailed examination of their wall structure, which is beyond the scope of this report.

In the light of the above considerations, the genera *Patellina* and *Patellinella* have been retained in this work, with *Discobolivina* placed in synonymy, and *Patellinella* transferred to the subfamily Discorbisinae. Parr (1950) appears to have arrived at the same conclusion by including *Patellinella* in the Discorbidae without comment.

Genus *Patellina* Williamson, 1858.

(286) *Patellina corrugata* Williamson.

Patellina corrugata Williamson, 1858, Rec. For. Gt. Britain, p. 46, pl. iii, figs. 86–89 ; Parr and Collins, 1930, p. 90, pl. iv, figs. 1–5.

The specimens found in this material are indistinguishable from the form found in British waters. Occasional specimens were found in samples of all groups.

(287) *Patellina altiformis* Cushman.

Patellina advena Cushman, var. *altiformis* Cushman, 1933*a*, Contrib. Cushman Lab. Foram. Res. **9**, pt. 4, p. 87, pl. 9, figs. 8*a*, *b*.
P. altiformis Cushman. Parr, 1950, p. 352.

Two specimens of this high-spired form were found in sample 29, Jukes Reef. It is present in Raine Island material but, strangely enough, is not found in the deeper-water sample 45, where it is replaced by the wider-ranging *P. corrugata*. Parr records it from off Tasmania.

Family ROTALIDAE.

Subfamily DISCORBISINAE.

Genus *Discorbis* Lamarck, 1804.

(288) *Discorbis rugosus* (d'Orbigny).

Rosalina rugosa d'Orbigny, 1839, Foram. Amer. Merid., p. 42, pl. ii, figs. 12–14.
Discorbina rugosa (d'Orbigny). Brady, 1884, p. 652, pl. lxxxvii, figs. 3*a–c* ; Millett, 1898 etc. (1903), p. 703 ; Chapman, 1901, p. 190 ; Heron-Allen and Earland, 1914 etc. (1915), p. 697.

The umbilical flaps developed on the ventral side of the test in this species, though simple in form, are apparently homologous with the more complex structures found in *D. vesicularis* and related forms. It is therefore considered as a species of *Discorbis* s. str. Common in sample 29, occasional in other samples of group 3.

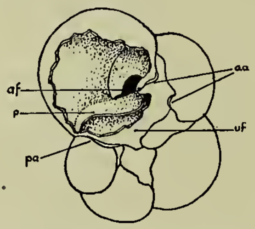
(289) *Discorbis subvesicularis* n. sp.

(Plate V, figs. 5*a*, *b* and *c*.)

Test trochoid, planoconvex, periphery broadly rounded and lobulate, 2–3 whorls, 6 chambers in the last whorl, wall thin and coarsely perforate. Dorsal side convex, chambers inflated, sutures depressed and recurved, in some specimens having a small triangular opening between the chambers at the junction of the suture with the previous whorl, passing between the chamber walls to the opposite side of the test. Ventral face slightly convex, sutures radial and slightly recurved, umbilicus masked by strongly-developed extensions of the chamber wall forming umbilical flaps. Commencing at the junction of the apertural face with the previous whorl, the edge of the flap is everted to form a broad lip covering a crescentic aperture extending radially toward the umbilicus. From the end of this primary aperture the edge of the flap turns at right angles and passes over and is attached to the surface of flaps formed by previous whorls. Where it meets the last suture, a short narrow crescentic lip is formed, covering an accessory aperture. From the end of this aperture the flap is attached to the wall of the preceding chamber, and then turns distally, parallel to the direction of coiling, and forms a longer, sigmoid lip covering a second accessory aperture. This aperture is terminated by the incurving and merging of the edge of the flap with the chamber wall.

Each flap, therefore, forms 3 arched, lipped apertures, separated by attached parts of the margin. The primary aperture is covered by the flap of the next succeeding chamber, the others remaining open in close proximity to the accessory apertures of the previous and following chambers. The flaps are perforate, but the pores are smaller and more scattered than those of the chamber wall proper.

While the apertural flaps do not form separate chamberlets, partial separation is made by a fold or partition about one-third the height of the chamber, originating from the peripheral end of the primary aperture, attached to the dorsal interior surface of the chambers for about half its length, running in a sigmoid curve and in a roughly circumferential direction to terminate on the ventral wall of the chamber just below the second accessory aperture. Immediately below and behind this point of attachment is the septal foramen connecting to the penultimate chamber (Text-fig. 1).



Text-fig. 1.—*Discorbis subvesicularis* n. sp. Specimen broken to show internal structures. *af* apertural foramen, *aa* accessory apertures, *p* partition, *pa* primary aperture, *uf* umbilical flap.

Earlier chambers have the same flap-like structure but simplified in form. The whole complex of cavities, baffles and passageways formed in the umbilical area by these flaps and the sigmoid partitions invites comparison with the canal systems of the more highly-developed rotalids.

No attempt has been made to apply the morphological nomenclature introduced by Hofker in describing these structures, as it is considered that the assumption of homologies which are not yet fully investigated is not advisable at this stage.

Holotype from sample 1.

Dimensions of holotype ; diameter 0·51 mm., thickness 0·22 mm.

A few specimens were found in most of the samples of groups 1, 2 and 3. This species is one of the *vesicularis-dimidiatus* group. It differs from *D. vesicularis* Lamarck from the Eocene of the Paris Basin in its rounded periphery (*D. vesicularis* being keeled, at least in the earlier chambers) and its more complex development of the umbilical region. It differs from the southern Australian recent species, *D. dimidiatus* (Parker and Jones), in its consistently smaller size, rounded periphery and somewhat less complicated umbilical structures. Cushman (1918 etc. (1931), p. 34) refers to a species from the Australian coast " which is very close to the Eocene species of Lamarck ", probably the form under consideration.

The closely allied species *D. dimidiatus* has been made the genotype of a new genus, *Lamellodiscorbis* Bermudez, 1952. After comparing it with specimens of *D. vesicularis* from the Eocene of Grignon, the author is of the opinion that the umbilical structures in the Australian species are no more than a larger and more complicated development of the alar projections seen in *D. vesicularis,* which are in some specimens widened at the extremities and recurved to form rudimentary supplementary apertures of similar nature to those found in the present species and in *D. dimidiatus*, though less developed. The differences between the present species and *D. vesicularis* are considered to be of specific value only, and it is therefore retained in *Discorbis* s. str.

In describing this species I have had the privilege of consulting an unpublished MS. dealing with the morphology of *D. dimidiatus*, by Mr. A. N. Carter of the Department of Mines, Victoria, to whom my thanks are due for the assistance thus given in working out the somewhat similar structures in the present species.

Genus *Discopulvinulina* Hofker, 1951.

(290) *Discopulvinulina bertheloti* (d'Orbigny).

Rosalinabertheloti d'Orbigny, 1839, *in* Barker-Webb and Berthelot, Hist. Nat. Iles Canaries, **2**, pt. 2, "Foraminifères," p. 135, pl. 1, figs. 28, 30.
Discorbis bertheloti (d'Orbigny). Cushman, 1918 etc. (1931), p 16, pl iii, fig. 2.
Discopulvinulina bertheloti (d'Orbigny). Hofker, 1951, p. 449.

Rare in the samples of group 3.

(291) *Discopulvinulina mira* (Cushman).

Discorbis mira Cushman, 1922, Publ. 311, Carn. Instit. Washington, p. 39, pl. 6, figs. 10, 11 ; 1918 etc. (1931), p. 25, pl. 5, figs. 5, 6*a–c* ; Parr, 1943, p. 16 ; Collins, 1953, p. 103.

Described from the West Indies, this species is evidently well distributed in Australian waters. It was recorded from Glenelg, S. Australia by Parr (1943), and from warm-water Pleistocene deposits in Victoria by the author (1953). Specimens are not uncommon in the samples of groups 1, 2 and 3, and compare well with West Indian examples.

(292) *Discopulvinulina lobatula* (Parr.)

Discorbina isabelleana Brady (not *Rosalina isabelleana* d'Orbigny) 1884, Rep. Voy. Chall., Zool. 9, p. 646, pl. lxxxviii, fig. 1.
Discorbis lobatulus Parr, 1950, p. 354, pl. xiii, figs. 23–25.

A few examples of this species were found in sample 45. It has a wide range in the Indo-Pacific and was recorded by Parr from off Tasmania.

(293) *Discopulvinulina subcomplanata* (Parr).

Discorbis subcomplanatus Parr, 1950, B.A.N.Z.A.R. Exped. Rept. V, pt. 6, p. 355, pl. xiv, figs. 1*a*, *b*, 2.

Rare in sample 1. This species was described from the Antarctic and is distinguished by its heavily limbate sutures on the dorsal side and its complanate form.

Genus *Rosalina* d'Orbigny, 1839.

(294) *Rosalina orbicularis* Terquem.

Rosalina orbicularis Terquem, 1876, Anim. sur la plage Dunkerque, p. 75, pl. ix, figs. 4*a*, *b*.
Discorbis orbicularis (Terquem). Berthelin, 1878, p. 39, no. 63 : Cushman, 1918 etc. (1931), p. 27, pl. 6, figs. 3*a–c* (synonymy).
Rosalina orbicularis Terquem. Bermudez, 1952, p. 34.

Good examples are common in samples 44 and 45.

(295) *Rosalina orientalis* (Cushman).

Discorbis globularis Heron-Allen and Earland (not of d'Orbigny), 1914 etc. (1915), p. 694, pl. li, figs. 36–39.
D. orientalis Cushman, 1925, Bernice P. Bishop Mus., Bull. 27, p. 130.

Probably the commonest of the smaller rotalids in the samples of groups 1, 2 and 3, this species has a wide Indo-Pacific range. It was described as having " the umbilical end of each chamber ending in a tooth-like process, bluntly pointed ". These processes originate in a flap-like extension of the chamber wall covering the umbilical extension of the aperture. As chambers are added, thickening of the shell wall at this point results in the formation of polished non-tubulate blebs on the inner margin of the chambers, varying from triangular tooth-shaped inwardly-pointing processes to groups of irregularly-rounded pustules.

As this form is related to *Rosalina globularis* d'Orbigny, it should be referred to that genus.

(296) *Rosalina frustata* (Cushman).

Discorbis frustata Cushman, 1933, Contrib. Cushman Lab. Foram. Res. **9**, pt. 4, p. 88, pl. 9, figs. 2*a–c*.

Described by Cushman from off Fiji, this species is very distinctive with its tiers of upward-curved, flanged chambers. Two specimens were found in sample 29.

Genus *Mississippina* Howe, 1930.

(297) *Mississippina pacifica* Parr.

Mississippina pacifica Parr, 1950, B.A.N.Z.A.R. Exped. Rept. V, pt. 6, p. 361, pl. xiv, figs. 17*a–c*.

Five specimens were found in sample 45. Parr records the species from Raine Island. The state of preservation of these specimens apparently differs from that of Parr's material from off Tasmania, the body of the test being white and opaque, while the peripheral areas are yellowish and translucent with a depressed margin.

Genus *Conorbella* Hofker, 1951.

(298) *Conorbella patelliformis* (Brady).

Discorbina patelliformis Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 647, pl. lxxxviii, fig. 1 ; Millett, 1898 etc. (1903), p. 700 ; Heron-Allen and Earland, 1914 etc. (1915), p. 703, pl. lii, fig. 32 ; Sidebottom, 1918, p. 254.
Discorbis patelliformis (Brady). Cushman, 1924, p. 33.
Conorbella patelliformis (Brady). Bermudez, 1952, p. 37.

This well-known Indo-Pacific species was found occasionally in the samples of groups 1, 2 and 3.

(299) *Conorbella pulvinata* (Brady).

Discorbina pulvinata Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 650, pl. lxxxviii, figs. 10*a*, *b* ; Heron-Allen and Earland 1914 etc. (1915), p. 702.
Conorbella pulvinata (Brady). Hofker, 1951, p. 470.

Rare, two specimens found in sample 26.

(300) *Conorbella pyramidalis* (Heron-Allen and Earland).

Discorbina pyramidalis Heron-Allen and Earland, 1924, Journ. Linn. Soc. Zool. **35**, p. 634, pl. 37, figs. 56–61.
Conorbella pyramidalis (Heron-Allen and Earland). Hofker, 1951, p. 470.

This species, described from Lord Howe Island and recorded by the authors from South and Western Australia, is represented by rare but typical specimens in the samples of groups 3 and 4.

(301) *Conorbella tabernacularis* (Brady).

Discorbina tabernacularis Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 648, pl. lxxxix, fig. 7 (not 5 and 6).
Conorbella tabernacularis (Brady). Hofker, 1951, p. 470.

Striate specimens similar to Brady's fig. 7 are not uncommon in all groups. It is doubtful, however, whether this form is conspecific with the large costate form of figs. 5 and 6, which was not found in the present material.

(302) *Conorbella corrugata* (Millett).

Discorbina corrugata Millett, 1898 etc. (1903), Journ. Roy. Micr. Soc., p. 700, pl. vii, fig. 5.

Rare in the samples of group 3, less frequent than *C. pyramidalis*, from which it differs in the greater number (5 to 6) and less regularity of the radial ridges on the dorsal side.

(303) *Conorbella opercularis* (d'Orbigny).

Rosalina opercularis d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 271, no. 7.
Discorbina opercularis (d'Orbigny). Brady, 1884, p. 650, pl. lxxxix, figs. 8, 9.
Conorbella opercularis (d'Orbigny). Bermudez, 1952, p. 37.

Four specimens from sample 45 are similar to those figured by Brady, which were from Queensland waters. Parr (1950) records the species from off Tasmania.

(304) *Conorbella earlandi* n. sp.

(Plate V, figs. 6*a*, *b* and *c*.)

Test minute, compressed, subhexagonal in outline, with slightly inflated chambers and a narrow keel. On the ventral side the sutures are straight and radial, slightly depressed, chambers triangular and somewhat inflated, with a depressed umbilicus. On the dorsal side all chambers are visible, subrectangular, 3 to 4 times as long as wide, arranged in a spiral hexagonal series, surface concave with the ends of the chambers curving up to form ridges which are continuous from the centre of the test to the periphery. Ventral side smooth, very finely perforate, dorsal side more coarsely perforate. Aperture is a narrow slit at the anterior margin of the last chamber on the ventral side, extending from the periphery to the umbilicus.

Holotype from sample 45.

Dimensions of holotype : Diameter 0·20 mm., thickness 0·07 mm.

Three specimens were found in sample 45, but a good series was available from Raine Island material. The geometric outline and ridged dorsal side suggest relationships with *C. pyramidalis* and *C. corrugata*, but in this case the ridges are caused by the upward-curved radial sutures, not by an angular form of the chamber itself. The species does not appear to be closely related to any described form.

This species was recognized as new by Mr. A. Earland in a slide mounted by him from Raine Island material and given to the late W. J. Parr for further study. I have great pleasure in associating it with his name, not only for this reason, but in inadequate acknowledgment of his helpful advice and encouragement over a period of many years.

Genus *Discorinopsis* Cole, 1941.

(305) *Discorinopsis tropica* n. sp.

(Plate V, figs. 7*a*, *b* and *c*.)

Test trochospiral in about 2 whorls, up to 10 chambers in last whorl ; dorsal side rounded with all chambers visible, coarsely perforate, sutures depressed-limbate ; ventral side flat or slightly concave, all but the last 2 chambers masked by irregular pustular shelly outgrowths. Periphery bluntly keeled, aperture a low slit on the ventral side of the periphery.

Holotype from sample 9.

Dimensions of holotype : Greater diameter 0·52 mm., thickness 0·17 mm.

One specimen was found in sample 9, and two others were available for study from the collection of the late W. J. Parr, their locality being Plum Beach, New Caledonia. The species differs from *D. aguayoi* Bermudez in its more regular form and bluntly keeled periphery.

Genus *Bronnimannia* Bermudez, 1952.

(306) *Bronnimannia haliotis* (Heron-Allen and Earland).

Discorbina haliotis Heron-Allen and Earland, 1924, Journ. Roy. Micr. Soc., pt. 2, p. 173, pl. xiii, figs. 99–101.
Discorbis haliotis (Heron-Allen and Earland). Parr, 1939, p. 68 ; Collins, 1953, p. 96.
Planulina haliotis (Heron-Allen and Earland). Chapman, 1941, p. 176.

This species was described from the Lower Miocene of Victoria and has since been recorded from the Lower Pliocene and Pleistocene. Parr records it from Geraldton Harbour, Western Australia, and mentions it as occurring at Barwon Heads, Victoria. Chapman records the species from 470 fathoms off the south-east coast of Australia. It occurs occasionally in the samples of groups 3 and 4.

Heron-Allen and Earland's figure (loc. cit.) does not show the full characteristics of the species. The sutures on the dorsal side are usually incurved, varying from a shallow indentation to a deep re-entrant, and leaving the umbilical margin of the chamber free of attachment. The author's figure shows a faint suggestion of this form, but gives a wrong impression of the suture as a simple curve. Specimens from the type locality show all stages, those with a deep re-entrant sinus being the more common. There is considerable variation in thickness of the test in the present material, some specimens being flat and compressed, others intermediate between these and the typical form.

This species is very close to the genotype, *B. palmerae* (Bermudez) which, however, is considerably thicker in proportion to diameter.

Genus *Poroeponides* Cushman, 1944.

(307) *Poroeponides lateralis* (Terquem).

Rosalina lateralis Terquem, 1878, Mem. Soc. Géol. France, ser. 5, 1, mem. III, p. 25, pl. ii, figs. 11*a*, *b*.
Poroeponides lateralis (Terquem). Cushman, 1944, p. 34 (synonymy).

This common Indo-Pacific species was met with in most of the samples, particularly those of group 3.

Genus *Patellinella* Cushman, 1928.

(308) *Patellinella jugosa* (Brady).

Textularia jugosa Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 358, pl. xlii, figs. 7*a*, *b*.
T. inconspicua Brady var. *jugosa* Brady. Millett, 1898 etc. (1899), p. 558, pl. vii, figs. 2*a*, *b*.
Discobolivina inconspicua (Brady). Hofker, (not of Brady) 1951, p. 431, text-fig. 296.

This well-marked species with ridged projecting sutures was rare in sample 45, one specimen only being found, which was closely comparable with specimens from Raine Island, the type locality. It is quite distinct from Brady's *Textularia inconspicua* which, as figured by Brady (1884) and by Parr and Collins (1930), has a smooth subconical outline with wide flush sutures of clear shell substance, the chamber walls being perforate with large closely-spaced pores. The latter species is common in Bass Strait, from which locality it was described. It has not been met with in the present samples, nor, in the author's experience, in any tropical material, though Brady records it from Nares Harbour, Admiralty Islands and from south of Japan, and Heron-Allen and Earland record it from the Kerimba Archipelago. The latter record does not appear to be correct, as the figured specimen has thin depressed sutures. Millett's figure of *Textularia inconspicua* (1898 etc., (1899), pl. vii, fig. 1). with its flared outline and markedly convex apertural face, is also distinct from the typical southern Australian form.

P. jugosa appears to be confined to tropical Australia and the regions to the north.

(309) *Patellinella nitida* (Hofker).

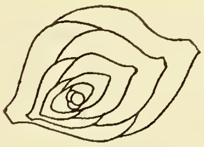
Discobolivina nitida Hofker, 1951, Siboga Exped., Part III, p. 498, text-figs. 293, 294.

This small depressed form, subcircular in end view, corresponds well with Hofker's description of specimens from south of Sumatra. Similar specimens were present in material from Challenger Stn. 185, Raine Island, mounted by Mr. A. Earland. Rare in sample 45.

(310) *Patellinella carinata* n. sp.

(Plate V, figs. 8*a*, *b*, *c*.)

Test minute, hyaline, commencing with a short trochoid spiral of 3 or 4 chambers, with later chambers added at 180° intervals (Text-fig. 2). Triangular in side view, with periphery slightly carinate, and set with fine apically-directed spines. Sutures distinct, arcuate, thin and almost flush, produced at the periphery as a larger spine. Chamber wall thin, transparent, finely perforate, with an irregular row of larger pores on the proximal side of each suture. In apertural view the test is ovoid with pointed ends, the distal chamber wall being thin, transparent and finely perforate, with a few larger pores scattered round the periphery and grouped near the outer ends. Aperture loop-shaped with a curved



Text-fig. 2.—*Patellinella carinata* n. sp. Specimen showing arrangement of early chambers.

toothplate, the aperture of the penultimate chamber being closed by what appears to be an extension of the toothplate.

Holotype from sample 45.

Dimensions of holotype : Length 0·18 mm., breadth 0·28 mm., thickness 0·16 mm.

This species is distinguished from others of the genus by its carinate and spinous periphery. It is fairly rare in the deeper-water sample 45, and is present in material from Challenger Stn. 185, Raine Island.

Subfamily VALVULINERIINAE.

Genus *Globorotalia* Cushman, 1927.

(311) *Globorotalia tumida* (Brady).

Pulvinulina menardii var. *tumida* Brady, 1877, Geol. Mag., Dec. II, 4, p. 535 ; 1884, p. 692, pl. ciii, figs. 4–6.
Globorotalia tumida (Brady). Cushman, 1927, p. 175.

Rare in sample 45 (one specimen).

(312) *Globorotalia canariensis* (d'Orbigny).

Rotalina canariensis d'Orbigny, 1839, *in* Barker-Webb and Berthelot, Hist. Nat. Iles Canaries, II, " Foraminiféres ", p. 130, pl. 1, figs. 34–36.
Globorotalia canariensis (d'Orbigny). Galloway and Morrey, 1929, p. 25, pl. 3, fig. 11.

Frequent in sample 45.

(313) *Globorotalia menardii* (d'Orbigny).

Rotalina menardii d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 273, no. 26.
Globorotalia menardii (d'Orbigny). Cushman, 1927, p. 175.

Rare in sample 45 (1 specimen).

Genus *Cancris* Montfort, 1808.

(314) *Cancris auriculus* (Fichtel and Moll).

Nautilus auricula Fichtel and Moll, 1803, Test. Micr., var., α p. 108, pl. 20, figs. *a–c.*
Cancris auriculus (Fichtel and Moll). Cushman and Todd, 1942, p. 74, pl. 18, figs. 1–11, pl. 23, fig. 6 (synonymy).

Not uncommon in the samples of groups 1, 2 and 3.

Genus *Eponides* Montfort, 1808.

(315) *Eponides procerus* (Brady).

Pulvinulina procera Brady, 1879 etc., (1881), Quart. Journ. Micr. Sci. XXI, p. 66 ; 1884, p. 698, pl. cv, figs. 7*a–c* ; Heron-Allen and Earland, 1914 etc. (1915), p. 717.

Rare in sample 45 (two specimens).

(316) *Eponides repandus* (Fichtel and Moll).

Nautilus repandus Fichtel and Moll, 1803, Test. Micr., p. 35, pl. 3, figs. *a–d.*
Eponides repandus (Fichtel and Moll). Montfort, 1808, 1, p. 127, 52e genre.

Rare in sample 10.

(317) *Eponides tubuliferus* (Heron-Allen and Earland).

Truncatulina tubulifera Heron-Allen and Earland, 1914 etc. (1915), Trans. Zool. Soc. London, XX, pt. 17, p. 710, pl. lii, figs. 37–40 ; Cushman, 1924, p. 38, pl. 11, fig. 8.

This small biconvex form with its peculiar development of tubules grouped within a crater-like tubercle on each dorsal chamber wall is rare in the samples of group 3. It has a wide Indo-Pacific distribution.

Genus *Gyroidinoides* Brotzen, 1948.

(318) *Gyroidinoides soldanii* (d'Orbigny).

Gyroidina soldani d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 278, no. 5.

Four specimens from sample 45 are small in size but otherwise typical of this wide-ranging species.

Subfamily GLOBOTRUNCANINAE.

Genus *Truncorotalia* Cushman and Bermudez, 1949.

(319) *Truncorotalia truncatulinoides* (d'Orbigny).

Rotalina truncatulinoides d'Orbigny, 1839, *in* Barker-Webb and Berthelot, Hist. Nat. Iles Canaries, II, " Foraminifères," p. 132, pl. ii, figs. 25–27.
Globorotalia truncatulinoides (d'Orbigny). Cushman, 1927, p. 176.
G. (*Truncorotalia*) *truncatulinoides* (d'Orbigny). Cushman and Bermudez, 1949, p. 35.

Rare in sample 45 (one specimen).

Subfamily EPISTOMININAE.

Genus *Höglundina* Brotzen, 1948.

(320) *Höglundina elegans* (d'Orbigny).

Rotalia (*Turbinulina*) *elegans* d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 276, no. 54.
Epistomina elegans (d'Orbigny). Cushman, 1918 etc. (1931), p. 66, pl. 13, figs. 6*a–c*.
Höglundina elegans (d'Orbigny). Brotzen, 1948, p. 92.

This well-known and widely-distributed species was common in sample 45, but not found in the shallower-water samples.

Genus *Rolshausenia* Bermudez, 1952.

(321) *Rolshausenia inflata* (Millett).

Rotalia schroeteriana Parker and Jones, var. *inflata* Millett, 1898 etc. (1904), Journ. Roy. Micr. Soc., p. 504, pl. x, figs. 5*a–c* ; Heron-Allen and Earland, 1914 etc. (1915), p. 719.

Specimens close to Millett's figure were not uncommon in the samples of groups 1, 2 and 3. Bermudez (1952) refers this form to his new genus *Rolshausenia*.

Genus *Torresina* Parr, 1947.

(322) *Torresina haddoni* Parr.

Torresina haddoni Parr, 1947*a*, Journ. Roy. Micr. Soc. LXIV, p. 133, pl. 1, figs. 4, 5*a–c*, 6*a–c*, text-fig. 3.

Three specimens of this recently-described species were found in sample 45. The largest, measuring 0·83 mm. in its greater diameter, showed on its ventral face the structure described by Parr as a " lunate apertural chamberlet ". As only one specimen showing this development was found, it was not examined by sectioning or breaking. However, examination in a liquid medium suggests that the " chamberlets " are in fact only curved inflated alar extensions of the ventral chamber wall with a deep sinus or re-entrant, basically similar to those seen in other discorbid genera.

The two smaller specimens measured 0·41 and 0·32 mm. in diameter respectively. The smaller was incomplete, the other showed only a simple, rather inflated alar flap extending over the preceding whorl. This specimen compared closely with a topotype specimen from Raine Island in Parr's collection, in which a similar structure was observed. The diameter of the proloculus of the two larger specimens was the same, *ca.* 0·08 mm. in diameter, that of the incomplete specimen being 0·03 mm., suggesting that it may be the microspheric form. There would appear to be little doubt that the large specimen figured by Parr (figs. 4 and 5*a–c*) represents the full development of the species, as suggested by its author.

Genus *Pseudoparrella* Cushman and Ten Dam, 1948.

(323) *Pseudoparrella pulchra* (Cushman).

Pulvinulinella pulchra Cushman, 1933*a*, Contrib. Cushman Lab. Foram. Research, **9**, pt. 4, p. 92, pl. 9, figs. 10*a–c*.

This minute form is fairly common in the finer fractions of the samples of groups 1, 2 and 3. Cushman states that it has a wide Indo-Pacific distribution.

Genus *Epistomaroides* Uchio, 1952.

(324) *Epistomaroides polystomelloides* (Parker and Jones).

Discorbina polystomelloides Parker and Jones, 1865, Phil. Trans. CLV, p. 421, pl. xix, figs. 8*a–c* ; Brady, 1884, p. 652, pl. xci, figs. 1*a–c* ; Heron-Allen and Earland, 1914 etc. (1915), p. 698, pl. liii, figs. 19–23.

(?) *Epistomaria polystomelloides* (Parker and Jones). Howchin and Parr, 1938, p. 303, pl. xvii, figs. 5–7, 11, 13.

Epistomaroides polystomelloides (Parker and Jones). Uchio, 1952, p. 158.

This common Indo-Pacific tropical species occurs in most of the samples of groups 1, 2 and 3. Specimens are of normal size, averaging about 1 mm. in diameter, and have the early chambers obscured by exogenous shell-growth in the form of granules which spread in an irregular manner along the sutures and in later chambers merge into the clear glassy struts which bridge the deep sutural grooves characteristic of this species. The incidence of this exogenous growth is rather variable, specimens from the Australian region showing a good deal of granulation and up to 4 or 5 sutural struts on the dorsal side, whereas East African specimens show little granulation and in most cases have the sutural struts confined to the periphery, possibly representing a geographical subspecies.

Occasionally very large specimens are found, apparently referable to this species but having an extreme development of exogenous shell-growth. Howchin and Parr record such a specimen, *ca.* 4 mm. in diameter, from the Upper Pliocene of Adelaide. No such specimens have been found in the present material, but the author has one from Longreach Bay, Rottnest Island, Western Australia (collected by Mr. L. Glauert) which reaches 5 mm. in diameter. In this specimen most of the surface is covered by an anastomosing network of deep narrow ridges of clear shell substance, the coarsely perforate shell wall showing in the interstices. These ridges, despite their apparent irregularity, are related to the sutural grooves, arising in a complex of radial and circumferential bars immediately over the grooves, and extending circumferentially over the chamber walls. In the earlier chambers the ridges anastomose, leaving small perforate areas between them. In the later chambers the circumferential extensions of the ridges do not meet over the chamber walls, and a large perforate area is exposed.

A specimen from Plum Beach, New Caledonia, in the author's possession from the collection of the late W. J. Parr, shows intermediate characteristics, being larger than the normal (1·68 mm. in larger diameter) and having the earlier chambers obscured by peculiar flat-topped vermiculate ridges which do not anastomose. This form, however, may be distinct from the present species.

The great disparity in size and comparative rarity of these larger specimens suggest that they may be the microspheric form of the species. Insufficient material is as yet available for sectioning to determine whether this is the case, or whether they are merely monstrous specimens showing gerontic characteristics.

Genus *Epistomariella* Kuwano, 1950.

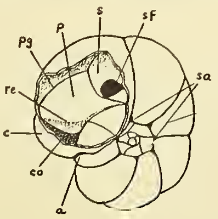
(325) *Epistomariella milletti*, n. sp.

(Plate V, figs. 9*a*, *b*, and *c*.)

Discorbina semimarginata Millett (not of d'Orbigny), 1898 etc. (1903), Journ. Roy. Micr. Soc., p. 703, pl. vii, figs. 8*a–c*.

Test trochoid and biconvex, dorsal side more convex than ventral, thin-walled, smooth, polished and finely perforate, periphery rounded and lobulate, sutures depressed. The ventral side shows inflated, roughly triangular chamberlets about two-thirds the radial height of the chamber proper, and tapering down to a deep umbilicus. The chamberlet walls are rather more densely perforate than the remainder of the test. At the peripheral junction of the chamberlet and the chamber, the wall of the test turns in to form a groove in which there is a slit-like supplementary aperture with a slight lip, connecting to the chamberlet. Attached to the underside of the groove is a partition wall which runs diagonally across the chamber and is attached to the septum of the preceding chamber and the periphery of the earlier whorl. It is not attached to the apertural face of the chamber, but has a rolled and thickened free edge, leaving a narrow space next to the apertural face which gives communication between chamber and chamberlet (Text-fig. 3).

On the dorsal side the chambers are inflated, and a supplementary slit-like aperture in the depressed suture communicates with the chamber. There is an indication of a narrow



Text-fig. 3.—*Epistomariella milletti* n. sp. Specimen broken to show internal structures. *a* primary aperture, *co* communicating opening, *c* chamberlet, *re* rolled edge of partition, *pg* peripheral groove, *p* partition, *s* septum, *sf* septal foramen, *sa* supplementary apertures.

aperture at the base of the apertural face, on the periphery of the earlier whorl, but it is indistinct and does not appear to be open. The septal foramen between chambers is semicircular and placed above the base of the septum.

Holotype from sample 23.

Dimensions of holotype : Greatest diameter 0·29 mm., thickness 0·13 mm.

Comparing the species with Millett's figures of the form which he referred to *Discorbina semimarginata* d'Orbigny, it would appear to be the same. Millett states that his form " bears a strong resemblance to *Discorbina rimosa* of Parker and Jones, but is devoid of the chinks between the chambers characteristic of that species ". The present species does possess " chinks ", but they are not at all obvious and are easily overlooked.

Hofker (1953) has studied specimens from the Lutetian of the Paris Basin which he refers to *D. semimarginata* (as *Epistomaria*), and places *D. rimosa* Parker and Jones, hitherto regarded as the genotype by original designation of Galloway's genus *Epistomaria*, in the synonymy of the former species. The original figures and descriptions of both these species are quite inadequate for the purpose of critical comparison, and it does not appear that the original material of either of the authors has been re-studied, leaving the question of the identity of *D. rimosa* with *D. semimarginata* somewhat doubtful.

With this reservation, *Epistomaria semimarginata* (d'Orbigny), as diagnosed by Hofker, has very different characteristics from the present species, in particular a granular, more or less opaque shell wall and a lobulate toothplate structure on the ventral side, rather than actual chamberlets.

The present species closely resembles the figures of *Discorbina rimosa* Parker and Jones, which is recorded by the authors from " Australian coral reefs " as well as from Grignon. Their description, however, mentions a thick shell wall and large pores, neither of which characteristics fit the present form. Considering the wide concept of species held by these authors, it is hard to say whether their figure or description referred to the Eocene or the Recent specimens studied by them, but it seems possible that their Australian specimens were actually the species now being dealt with, lumped with the Eocene form on the grounds of certain similarities such as the marginal apertures. If this were the case, it might explain the disparity between their figure with its smooth, apparently poreless surface and the description quoted above, if the figures were executed from recent specimens. This could only be decided by reference to the original material.

The generic position of this species presents some difficulties. *Epistomariella* Kuwano, 1950 was erected for the reception of forms with a smooth, finely perforate shell wall and rudimentary chamberlets. However, the distinctions between the granular wall of *Epistomomaria* (*fide* Hofker), the coarsely perforate wall of *Epistomaroides* and the finely perforate and smooth wall of *Epistomariella* appear to be more fundamental than the degree of develoment of chamberlets, and the present specimens are therefore placed in *Epistomariella* on this basis.

Genus *Anomalinella* Cushman, 1927.

(326) *Anomalinella rostrata* (Brady).

Truncatulina rostrata Brady, 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, p. 65 ; 1884, p. 668, pl. xciv, figs. 6*a*–*c*.

Anomalinella rostrata (Brady). Cushman, 1927*a*, p. 93.

Rare in sample 40. This species has a generally Eastern Pacific distribution.

Genus *Siphonina* Reuss, 1856.

(327) *Siphonina tubulosa* Cushman.

Siphonina tubulosa Cushman, 1924, Publ. 342, Carnegie Instit. Washington, p. 40, pl. 13, figs. 1, 2.

This species has a wide Indo-Pacific distribution and occurs also in southern Australian waters. Rare in samples of groups 1, 2 and 3.

Genus *Siphoninoides* Cushman, 1927.

(328) *Siphoninoides echinatus* (Brady).

Planorbulina echinata Brady, 1879, Quart. Journ. Micr. Sci. XIX, p. 283, pl. viii, fig. 31.
Truncatulina echinata Brady, 1884, p. 670, pl. xcvi, figs. 9–14 ; Millett, 1898 etc. (1904), p. 490 ; Heron-Allen and Earland, 1914 etc. (1915), p. 711.
Siphoninoides echinata (Brady). Cushman, 1927, p. 77, pl. 16, fig. 12.

Rare in the samples of groups 1, 2 and 3.

(329) *Siphoninoides glabrus* (Heron-Allen and Earland).

Truncatulina glabra Heron-Allen and Earland, 1914 etc. (1915), Trans. Linn. Soc. London, Zool., XX, pt. 17, p. 711, pl. lii, figs. 41–47.
Siphoninoides glabra (Heron-Allen and Earland). Cushman, 1927*b*, p. 13.

This smooth form was rather more common than *S. echinatus* in the samples of group 1, 2 and 3.

Subfamily ROTALIINAE.

Genus *Rotalia* Lamarck, 1804.

(330) *Rotalia erinacea* Heron-Allen and Earland.

Discorbina imperatoria (d'Orbigny), var. *globosa* Millett (not *Nonionina globosa* v. Hagenow), 1898 etc. (1903), Journ. Roy. Micr. Soc., p. 701, pl. vii, figs. 6*a–c*.
Rotalia erinacea Heron-Allen and Earland, 1914 etc. (1915), Trans. Linn. Soc. London, Zool. XX, pt. 17, p. 720, pl. liii, figs. 23–26.

This minute species with its globose chambers and long slender spines was rare but well distributed in the shallow-water samples of groups 1, 2 and 3. The apertural characteristics are obscure, but it does not appear to possess the angled extension of the aperture into the apertural face, regarded by Finlay (1939) as diagnostic of the spined genus *Calcarina*. It is therefore left in *Rotalia* as described, with some doubt.

(331) *Rotalia murrayi* Heron-Allen and Earland.

Rotalia murrayi Heron-Allen and Earland, 1914 etc. (1915), Trans. Linn. Soc. London. Zool. XX, pt. 17, p. 721, pl. liii, figs. 27–34.

This species has approximately the same distribution in these samples as *R. erinacea*. The aperture appears to open into the umbilical cavity, but is obscure, and the affinities of the species remain rather doubtful. It is therefore recorded as described.

Genus *Streblus* Fischer, 1817.

(332) *Streblus papillosus* (Brady).

Rotalia papillosa Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 708, pl. clv, figs. 9*a*, *b*, *c*.

This typical Indo-Pacific species was fairly common in the samples of group 3.

(333) *Streblus convexus* n. sp.

(Plate V, figs. 10*a*, *b* and *c*.)

Test subcircular in outline, dorsal side convex, ventral side flattened, periphery rounded and slightly lobulate. Chambers on dorsal side are in 2–3 whorls with up to 11 chambers in the last whorl, sutures oblique, clear and slightly limbate. Chambers on ventral side triangular, wall finely punctate, suture splitting near periphery and leaving a tapering groove which deepens toward the umbilicus, chambers edged with a thin imperforate limbate margin, rounded at the umbilical angle and forming an apical knob of clear shell material in the earlier chambers only. Umbilicus partly filled with a large flat-topped plug, subpolygonal in shape and sparsely perforate. Aperture consists of a low slit at the umbilical margin of the last chamber.

Holotype from sample 8. Occurs in the samples of groups 1, 2 and 3.

Dimensions of holotype : Diameter 0·56 mm., thickness 0·36 mm.

This species differs from *S. beccarii* (Linnaeus) in its smaller dimensions, greater convexity on dorsal side and less exogenous shell growth.

(334) *Streblus tepidus* (Cushman).

Rotalia beccarii (Linnaeus), var. tepida Cushman, 1926*b*, Publ. 344 Carnegie Instit., Washington, p. 79, pl. 1.
Streblus catesbyanus (d'Orbigny), var. *tepida* (Cushman). Bermudez, 1952, p. 74, pl. xii, fig. 3.

Specimens have been compared with examples of Cushman's variety from the Dry Tortugas, Florida, and are found to be inseparable. This small and delicate form, which does not exceed 0·35 mm. in diameter, is very different from the large, heavy and decorated *S. beccarii* from the Adriatic. Bermudez has placed it as a variety of *S. catesbyanus* d'Orbigny, presumably on account of its lack of an umbilical plug. Its distinctive characters, together with its apparently wide tropical distribution, are here considered to justify its specific separation.

Family CERATOBULIMINIDAE.

Subfamily CERATOBULIMINAE.

Genus *Geminospira* Makiyama and Nakigawa, 1941.

(335) *Geminospira bradyi* Bermudez.

Bulimina convoluta Brady (not *B. pupoides* var. *convoluta* Williamson), 1884, Rep Voy Chall., Zool. **9**, p. 409, pl. cxiii, figs. 6*a*, *b* ; Millett, 1898 etc. (1900), p. 274, pl. ii, fig. 9.
Pseudobulimina convoluta Glaessner (not of Williamson), 1937, p. 23, pl. 2, figs. 26, 27 ; Cushman, 1947, p. 77 ; Hofker, 1950, p. 386, text-figs. 265, 267.
Geminospira bradyi Bermudez, 1952, pl. xiii, figs. 7*a*, *b* (no description or synonymy).

Four specimens of this rare form were found in sample 45. Hofker (loc. cit.) has studied the internal structures in detail, and the author has nothing to add, except to note that in well-preserved specimens there is a clear area surrounding the apertural fold and extending for some distance dorsally, ventrally and toward the periphery, bordered by a densely perforated area which extends to the suture, as in the genus *Cancris*. This feature is suggested in Millett's figure of the species.

The nomenclature of this species has long been doubtful. The identity of Brady's and Millett's specimens from the tropical Indo-Pacific with Williamson's North Atlantic species has been seriously questioned, although the author is unaware of any actual comparisons being made between specimens representing the original material studied by these authors, or even specimens from the two localities concerned. With these reservations, the re-naming of Brady's form by Dr. Bermudez appears to be well justified.

The earlier relegation of this species to the genus *Pseudobulimina* Earland has little to justify it when comparison is made with the type species of that genus, *P. chapmani* Heron-Allen and Earland. The wall in *G. bradyi* is thin and transparent, and in *P. chapmani* thick and opaque, though it must be noted that Wood (1948) found that the shell wall in both species was radiate. The evolute development of the former contrasted with the tight helicoid spiral of the latter is also noteworthy, and in all the differences amount to quite as much as between some well-established genera of the Rotalidea.

Genus *Cushmanella* D. K. Palmer and Bermudez.

(336) *Cushmanella primitiva* Cushman and McCulloch.

Cushmanella primitive Cushman and McCulloch, 1940, Allan Hancock Pacific exped. **6**, pt. 3, p. 163, pl. 18, figs. 6–8, 10.

A few specimens referable to this species were found in most of the deeper-water dredgings of groups 3 and 4, and occasionally in shallow-water samples. Generally they agree well with the original description, but show a peculiar patterning in the wall caused by irregular lobulate areas of clear shell substance which contrast with the finely-perforate character of the wall in general. The supplementary aperture in the apertural face is small, rounded and obscure, usually marked by a depression in the wall. It can, however, be seen as a rounded opening in the septal face of the penultimate chamber, where it is presumably enlarged by resorption.

Genus *Lamarckina* Berthelin, 1881.

(337) *Lamarckina scabra* (Brady).

Pulvinulina oblonga Williamson, var. *scabra* Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 689, pl. cvi, fig. 8.
Lamarckina scabra (Brady). Cushman, 1926*c*, p. 13.

Rare, one specimen in sample 44.

Subfamily ROBERTININAE.

Genus *Robertina* d'Orbigny, 1846.

(338) *Robertina tasmanica* Parr.

Robertina tasmanica Parr, 1950, B.A.N.Z.A.R. Exped. Rept. V, pt. 6. Foraminifera, p. 369, pl. xv, figs. 10*a*, *b*, 11*a*, *b*.

Four specimens from sample 45 are referable to this species, described from off Tasmania.

(339) *Robertina australis* n. sp.

(Plate V, figs. 11*a*, *b*.)

Test irregularly fusiform with inflated chambers and lobulate outline, variable in proportions, the length/width ratio varying from 1·65 : 1 to 2·55 : 1. Chambers roughly equal in height and width, up to 6 in the last whorl. Initial end subacute, oral end broadly rounded. Chamber wall thin, fragile and transparent. Aperture loop-shaped, inclined to the axis of the test, in a shallow depression in the face of the last chamber. No secondary aperture was observed.

Holotype from sample 45, where it is not uncommon.

Dimensions of holotype : Length 0·39 mm., width 0·20 mm.

This species has the slender proportions of *R. subteres* (Brady), in some specimens at any rate, but differs in the inflation of the chambers and the lobulate outline.

Genus *Robertinoides* Höglund, 1947.

(340) *Robertinoides oceanicus* (Cushman and Parker).

Robertina oceanica Cushman and Parker, 1947, U.S. Geol Survey Prof. Paper 210–D, p. 75, pl. 18, fig. 18.

One specimen was found in sample 45. The presence of a second aperture in the sutural junction of the last and penultimate chambers is clearly shown in the type figure and is apparent in the specimen studied. As only one specimen was available, the internal features could not be effectively studied, but the external features place the species in the genus *Robertinoides*.

(341) *Robertinoides subcylindricus* (Brady).

Bulimina subcylindrica Brady, 1879 etc. (1881), Quart. Journ. Micr. Sci. XXI, p. 56 ; 1884, p. 404, pl. 1, figs. 16*a*, *b*.

Robertina subcylindrica (Brady) Cushman and Parker, 1947, p. 75, pl. 18, fig. 13 (synonymy).

One small specimen from sample 45 has the long embracing early chambers of this species. Brady's figures do not show the accessory aperture at the junction of the last 2 chambers. It is, however, clear in the present specimen and others in the author's possession. Cushman and Parker mention " supplementary apertures very inconspicuous " in their diagnosis. The presence of the accessory aperture in this well-marked species places it in the genus *Robertinoides*.

Fmily ANOMALINIDAE.

Subfamily ANOMALININAE.

Genus *Anomalina* d'Orbigny, 1826.

(342) *Anomalina tasmanica* Parr.

Anomalina tasmanica Parr, 1950, B.A.N.Z.A.R. Exped. Rept. V, pt. 6, Foraminifera, p. 363, pl. xiv, figs. 4*a–c*.

Not uncommon in sample 45. This is another example of the general relationship of the deeper-water assemblage to that of south-east Australia.

(343) *Anomalina colligera* Chapman and Parr.

Anomalina ammonoides Brady (not *Rosalina ammonoides* Reuss), 1884, Rep. Voy. Chall., Zool. **9**, p. 672, pl. xciv, figs. 2, 3.
A. colligera Chapman and Parr, 1937, Aust. Antarctic Exped. 1911–14, Sci. Repts., ser. C, 1, (2), p. 117, pl. ix, fig. 26; Parr, 1950, p. 362, pl. xv, figs. 3*a–c*.

This widely-distributed form is not uncommon in sample 45.

Subfamily CIBICIDINAE.

Genus *Cibicides* Montfort, 1808.

(344) *Cibicides praecinctus* (Karrer).

Rotalia praecincta Karrer, 1868, Sitzungsb. d. k. Ak. Wiss. Wien, lvii, p. 189, pl. v, fig. 7.
Truncatulina praecincta (Karrer). Brady, 1884, p. 667, pl. xcv, figs. 1–3.

Specimens agreeing very well with Brady's figures are not uncommon in the samples of group 3. The species has been placed in *Eponides*, but the present specimens show the aperture continuing along the dorsal inferior border of the chamber as in typical *Cibicides*.

(345) *Cibicides subhaidingeri* Parr.

Truncatulina haidingeri Brady (not *Rotalia haidingeri* d'Orbigny) 1884, Rep. Voy. Chall., Zool. **9**, p. 663, pl. xcv, fig. 7.
Cibicides subhaidingeri Parr, 1950, p. 364, pl. xv, figs. 7*a–c*.

Common in sample 45.

(346) *Cibicides lobatulus* (Walker and Jacob).

Nautilus lobatulus Walker and Jacob, 1798, Adams Essays (Kanmacher's Edn.), p. 642, pl. xiv, fig. 36.
Cibicides lobatulus (Walker and Jacob). Cushman, 1918 etc. (1931), p. 118, pl. xxi, fig. 3.

Occasional in the samples of groups 1, 2 and 3, common in sample 26.

Family AMPHISTEGINIDAE.

Genus *Amphistegina* d'Orbigny, 1926.

(347) *Amphistegina radiata* (Fichtel and Moll).

Nautilus radiatus Fichtel and Moll, 1798, Test. Micr., p. 58, pl. 8, figs. *a–d*.
Amphistegina radiata (Fichtel and Moll). Hofker, 1927, p 76, pls. xxix, xxx, figs. 2, 3, 4, 6 and 7 (synonymy).

One of the commonest larger foraminifera in the shallow-water samples of groups 1, 2 and 3.

Family CALCARINIDAE.

Genus *Calcarina* d'Orbigny, 1826.

The interpretation of this genus is still a matter of disagreement amongst systematists, as to whether it should apply to the "*Rotalia*" *calcar* and *R. venusta* group or to the more complex rotalids of the *spengleri* group. The author accepts the views of Finlay (1939) based on Galloway's 1933 classification, that *Calcarina calcar* d'Orbigny is the genotype of this genus, and that the *spengleri* group is correctly placed in Montfort's genus *Tinoporus* with *T. baculatus* Montfort as its genotype.

(348) *Calcarina calcar* d'Orbigny.

Calcarina calcar d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 276, no. 1, Modèles no. 34.
Rotalia calcar (d'Orbigny). Brady, 1884, p. 709, pl. cviii, figs. 3, 4.
Calcarina calcar d'Orbigny. Finlay, 1939, p. 526.

Common in practically all the shallow-water samples of groups 1, 2 and 3.

(349) *Calcarina venusta* (Brady).

Rotalia venusta Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 708, pl. ciii, figs. 2*a–c*.
Calcarina venusta (Brady). Finlay, 1939, p. 524.

Frequent in the samples of group 3, but not so common or well-distributed as *C. calcar*. Some specimens develop short spines on the periphery, one to each chamber, confirming further the generic relationship to *C. calcar* as adduced by Finlay from apertural characteristics.

Genus *Tinoporus* Montfort, 1808.

(350) *Tinoporus baculatus* Montfort.

Tinoporus baculatus Montfort, 1808, Conchyl. Syst. **1**, p. 46, 37e genre.
Calcarina baculatus (Montfort). Cushman, 1919*a*, pp. 363–368, pl. 1, fig. 3.

Specimens closely following Cushman's diagnosis of this species are not uncommon in the samples of groups 1, 2 and 3. Finlay (1939) has shown that *Tinoporus* Montfort is a valid genus, despite inadequacies and discrepancies in description and figuring, since it is based on the present species (Cushman 1919), giving it a clearly recognizable type species. The use of *Tinoporus* for the *spengleri-baculatus* group rather than the later *Calcarina* d'Orbigny has the practical advantage of allowing the latter to be retained for the *C. calcar* group of rotalids, which are distinct from both *Rotalia* and *Tinoporus*.

It may be noted that Brady's fig. 7, pl. cxiii of the " Challenger " Report appears to belong to this species, rather than *spengleri* to which Brady refers it.

(351) *Tinoporus hispidus* (Brady).

Calcarina hispida Brady, 1876, Proc. Roy. Irish Acad., ser. 2, **2**, p. 590 ; 1884, p. 713, pl. cviii, figs. 8 and 9.

This well-known species occurs commonly in the samples of groups 1, 2 and 3, usually together with *T. baculatus*.

Genus *Baculogypsina* Sacco, 1893.

(352) *Baculogypsina sphaerulata* (Parker and Jones).

Orbitolina sphaerulata Parker and Jones, 1860, Ann. Mag. Nat. Hist., ser. 3, VI, p. 33, no. 8.
Tinoporus baculatus Carpenter (not of Montfort), 1860, p. 557, pls. xviii, xxi ; Brady, 1884, p. 716, pl. ci, figs. 4–7.
Baculogypsina sphaerulata (Parker and Jones). Sacco, 1893, p. 206.
Tinoporus baculatus var. *florescens* Chapman, 1901, p. 386, pl. 36, fig. 4.

This species is found in great quantities in the coarser sediments of the littoral region and is rare or absent in deeper-water samples, whether mud or coral sand. It is one of the few forms with tests able to withstand the pounding of surf, and is hence recognizable as a constituent of the coarser sediments from the surf zone where few other forms survive.

Wherever the species is found in abundance in these samples a small proportion of the tests are found to have flattened and furcate spines, similar to topotype specimens of Chapman's variety *florescens* from the collection of the late W. J. Parr. Variation ranges from specimens with 1 or 2 spines flattened at the tips to those with groups of short radiating spines which project from the surface of the test in 3 or 4 places. The occurrence of these forms in populations of the typical species suggests that they are individual abnormalities caused by factors such as the accidental coalescence of 2 or more spines, and as such not justifying nomenclatorial distinction.

Family CYMBALOPORIDAE.

Genus *Cymbaloporetta* Cushman, 1928.

(353) *Cymbaloporetta bradyi* (Cushman).

Cymbalopora poeyi (d'Orbigny) var., Brady, 1884, p. 637, pl. cii, fig. 14.
C. bradyi Cushman, 1924, Publ. 342, Carnegie Instit. Washington, p. 34, pl. 10, figs 2–4.

Common in all groups.

(354) *Cymbaloporetta squammosa* (d'Orbigny).

Rotalia squammosa d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 272, no. 8.
Cymbaloporetta squammosa (d'Orbigny). Cushman, 1928*a*, p. 7.

Common in all groups.

Genus *Cymbaloporella* Cushman, 1927.

(355) *Cymbaloporella tabellaeformis* (Brady).

Cymbalopora tabellaeformis Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 727, pl. cii, figs. 15–18.
Cymbaloporella tabellaeformis (Brady). Cushman, 1927*a*, p. 81, pl. 17, fig. 7.

Occasional in all groups.

Genus *Tretomphalus* Moebius, 1880.

(356) *Tretomphalus milletti* (Heron-Allen and Earland).

Cymbalopora bulloides Millett (not of d'Orbigny), 1898 etc. (1903), Journ. Roy. Micr. Soc., p. 697, pl. vii, fig. 4.
C. milletti Heron-Allen and Earland, 1914 etc. (1915), p. 689, pl. li, figs. 32–35.
Tretomphalus milletti (Heron-Allen and Earland). Cushman, 1934, p. 36, pl. 11, fig. 4.

Fairly common in sample 24, occasional in other samples.

(357) *Tretomphalus planus* Cushman.

Tretomphalus bulloides (d'Orbigny) var. *plana* Cushman, 1924, Publ. 342, Carnegie Instit. Washington, p. 36, pl. 10, fig. 8.
T. planus Cushman, 1934*a*, p. 94, pl. 11, figs. 11*a*–*c*, pl. 12, figs. 18–22.

Occasional specimens in all groups.

(358) *Tretomphalus clarus* Cushman.

Tretomphalus clarus Cushman, 1934*a*, Contrib. Cushman Lab. Foram. Research, **10**, pt. 4, p. 99, pl. 11, figs. 6*a–c*, pl. 12, figs. 16, 17.

The *Discorbis*-stage of this species was not uncommon. Some fine specimens with float-chambers intact were found in sample 27.

Family Elphidiidae.

In this report the genera *Nonion* and *Nonionella* have been treated as belonging to the family Chilostomellidae on the grounds of likeness in wall structure, following the work of Wood (1948). This requires a change in the family name Nonionidae as used in Bermudez' classification of the Rotalidea, which has otherwise been followed. It appears preferable to base any such changed family name on the oldest-established and most typical genus, *Elphidium.*

Genus *Elphidium* Montfort, 1808.

(359) *Elphidium advenum* (Cushman).

Polystomella subnodosa Brady (not of Montfort), 1884, p. 734, pl. cx, figs. 1*a*, *b* ; Chapman, 1901, p. 203 ; Millett, 1898 etc. (1904), p. 604 ; Heron-Allen and Earland, 1914 etc. (1915), p. 753.
P. advena Cushman, 1922, Publ. 311, Carnegie Instit. Washington, p. 56, pl. 9, figs. 11, 12.
Elphidium advenum (Cushman), 1918 etc. (1930), p. 25, pl. 10, figs. 1, 2.

This common Indo-Pacific species was found in most of the samples of groups 1, 2 and 3.

(360) *Elphidium craticulatum* (Fichtel and Moll).

Nautilus craticulatus Fichtel and Moll, 1798, Test. Micr., p. 51, pl. 5, figs. *h–k*.
Polystomella craticulata (Fichtel and Moll). d'Orbigny, 1826, p. 284, no. 3.
Elphidium craticulatum (Fichtel and Moll). Cushman, 1932 etc. (1933), p. 48, pl. 11, figs. 5*a*, *b*.

This large coral-reef species was common in the coarser fractions of the samples of groups 1, 2 and 3.

(361) *Elphidium crispum* (Linné).

Nautilus crispus Linné, 1758, Syst. Nat., ed. 10, p. 709.
Polystomella crispa (Linné). Lamarck, 1816 etc. (1822), p. 625.
Elphidium crispum (Linné). Cushman, 1939, p. 50, pl. 13, figs. 17–21 (synonymy).

Large well-developed specimens were common in the samples of groups 1, 2 and 3.

(362) *Elphidium hispidulum* Cushman.

Elphidium hispidulum Cushman, 1936*a*, Contr. Cushman Lab. Foram. Research, **12**, pt. 4, p. 83, pl. 14, 14, figs. 13*a*, *b*.

Frequent in most of the samples of groups 1, 2 and 3. It was described from Western Australia, and appears to be confined to the warmer coastal waters of Australia.

(363) *Elphidium* sp. aff. *josephinum* (d'Orbigny).

(Plate V, fig. 12.)

aff. *Polystomella josephina* d'Orbigny, 1846, For. Foss. bassin Tert. Vienne, p. 130, pl. 6, figs. 25, 26.
Elphidium josephinum (d'Orbigny). Cushman, 1939, p. 43, pl. 11, fig. 15 (synonymy).

One specimen from sample 9 is very close to Cushman's figure of this species. Records are confined to the Miocene of central and southern Europe, but it is not unusual for species originating in this region or their close congeners to be found living in the Indo-Pacific.

(364) *Elphidium limbatum* (Chapman).

Polystomella macella (Fichtel and Moll) var. *limbata* Chapman, 1909, Journ. Quekett Micr. Club, ser, 2, **10**, p. 142, pl. 10, figs. 9*a*, *b*.

Elphidium macellum (Fichtel and Moll) var. *limbata* (Chapman). Cushman, 1932 etc. (1933), p. 50, pl. 11, figs. 9*a*, *b*.

Specimens are closely similar to those from the type locality, Port Phillip Bay, Victoria. It occurs there together with *E. macellum* s. str., and therefore cannot be regarded as a geographical subspecies. The characters are well marked, and it has a wide Indo-Pacific range, being recorded by Cushman from Fiji. It is therefore treated as a distinct species in this report.

Specimens are not uncommon in the samples of groups 1, 2 and 3.

(365) *Elphidium oceanicum* Cushman.

Elphidium oceanicum Cushman, 1932 etc. (1933), U.S. Nat. Mus. Bull. **161**, pt. 2, p. 52, pl. 12, figs. 7*a*, *b*.

This small species is fairly rare, 1 or 2 specimens per sample being found in many of the samples of groups 1, 2 and 3.

(366) *Elphidium pacificum* n. sp.

(Plate V, fig. 13.)

Elphidium milletti Cushman (not *Polystomella milletti* Heron-Allen and Earland), 1932 etc. (1933), U.S. Nat. Mus. Bull. **161**, pt. 2, p. 49, pl. 11, figs. 8*a*, *b*.

Three specimens very close to Cushman's figure of a form from the Tonga Islands were found in sample 45. Compared with the original figures of *E. milletti* from the Kerimba Archipelago and with East African specimens which are clearly referable to this species, the present form is seen to differ widely. The outline is much more lobulate and irregular than in *E. milletti,* and the costae, instead of being low or broken and beaded, are high and ridged, tending to obscure the sutures. The rounded periphery and slightly angled form of the costae are the only real points of similarity between the two forms, and it is considered that they are specifically distinct.

Family GLOBIGERINIDAE.

Subfamily GLOBIGERININAE.

Genus *Globigerina* d'Orbigny, 1826.

(367) *Globigerina bulloides* d'Orbigny.

Globigerina bulloides d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 277. no. 1. Modèles no. 17 and no. 76.

Occasional specimens of this wide-ranging species were found in all groups.

(368) *Globigerina* sp. cf. *dubia* Egger.

cf. *Globigerina dubia* Egger, 1857, Neues Jahrb. für. Min. etc., p. 281, pl. ix, figs. 7.9 ; Brady, 1884, p 595, pl. lxxix, figs. 17*a–c*.

Rare in sample 39. This form, which is low-spired, is referred doubtfully to *G. dubia*, rather than the Pacific species *G. eggeri* Rhumbler.

Genus *Globigerinella* Cushman, 1927.

(369) *Globigerinella aequilateralis* (Brady).

Globigerina aequilateralis Brady, 1879, Quart. Journ. Micr. Sci. XIX, p. 71 ; 1884, p. 605, pl. lxxx, figs. 18–21.
Globigerinella aequilateralis (Brady). Cushman, 1927*a*, p. 87.

Rare in sample 45 (1 specimen).

Genus *Globigerinoides* Cushman, 1927.

(370) *Globigerinoides sacculiferus* (Brady).

Globigerina sacculifera Brady, 1877, Geol. Mag., Dec., II, IV, p. 535 ; 1884, p. 604, pl. lxxx, figs. 11–17, pl. lxxxii, fig. 4.
Globigerinoides sacculifera (Brady). Cushman, 1927, p. 173.

Common in sample 45.

(371) *Globigerinoides conglobatus* (Brady).

Globigerina conglobata Brady, 1879, Quart. Journ. Micr. Sci. XIX, p. 72 ; 1884, p. 603, pl. lxxx, figs. 1–5, pl. lxxxii, fig. 5.
Globigerinoides conglobata (Brady). Cushman, 1927*a*, p. 173.

Occasional specimens were found in all groups.

Subfamily PULLENIATININAE.

Genus *Pulleniatina* Cushman, 1927.

(372) *Pulleniatina obliquiloculata* (Parker and Jones).

Pullenia obliquiloculata Parker and Jones, 1865, Phil. Trans. CLV, pp. 368, 421, pl. xix, fig. 4.
Pulleniatina obliquiloculata (Parker and Jones). Cushman, 1927*a*, p. 90, pl. 19, fig. 5.

Rare in sample 45 (2 specimens).

Genus *Sphaeroidinella* Cushman, 1927.

(373) *Sphaeroidinella dehiscens* (Parker and Jones).

Sphaeroidina dehiscens Parker and Jones, 1865, Phil. Trans. CLV, p. 369, pl. xix, figs. 5*a*, *b*.
Sphaeroidinella dehiscens (Parker and Jones). Cushman, 1927*a*, p. 90, pl. 19, fig. 2.

One typical specimen was found in sample 45.

Family PEGIDIIDAE.

Genus *Physalidia* Heron-Allen and Earland, 1928.

(374) *Physalidia ? reniformis* (Heron-Allen and Earland).

Discorbina reniformis Heron-Allen and Earland, 1914 etc. (1915), Trans. Zool. Soc. London, XX, pt. 17, p. 696, pl. lii, figs. 7–14.

Two specimens were found in sample 29. The position of this rarely-recorded species is doubtful, though it definitely does not belong in *Discorbis* s. str., and is probably not closely related to that genus. It is here referred with some doubt to the genus *Physalidia* because of its ovoid shape, its thick, pitted and coarsely-perforate shell wall, and its obscure aperture. This genus was described as having opposed chambers, but the figures of some species (cf. *P. earlandi* Bermudez) could be interpreted as showing loose spiral growth. The present species is trochospiral, tending to open out in the last 1 or 2 chambers. Taking all the observed characters into account, its affinities are probably with the Pegidiidae.

Genus *Pegidia* Heron-Allen and Earland, 1928.

(375) *Pegidia dubia* (d'Orbigny).

Rotalia dubia d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 274, no. 24.
Pegidia dubia (d'Orbigny). Heron-Allen and Earland, 1928, Journ. Roy. Micr. Soc., p. 294.

Two characteristic specimens of this rarely-recorded species were found, one each in samples 35 and 40.

Family PLANORBULINIDAE.

Subfamily PLANORBULININAE.

Genus *Planorbulina* d'Orbigny, 1826.

(376) *Planorbulina rubra* d'Orbigny.

Planorbulina rubra d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 200, no. 4 (*nomen nudum*).
Gypsina rubra (d'Orbigny). Heron-Allen and Earland, 1914 etc. (1915), p. 725, pl. liii, figs. 35–37.
Planorbulina rubra d'Orbigny. Parr, 1932, p. 232, pl. xxii, figs. 51*a–c* ; 1950, p. 368.

Parr has recorded this species from various localities on the Australian coast. Large incrusting specimens were found in some of the samples of groups 2 and 3, some with a faint pink tinge, but mostly white.

(377) *Planorbulina acervalis* Brady.

Planorbulina acervalis Brady, 1884, Rep. Voy. Chall., Zool. **9**, p. 637, pl. xlii, fig. 4.

Occasional specimens were found in most of the samples of groups 1, 2 and 3.

Genus *Acervulina* Schultze, 1854.

(378) *Acervulina inhaerens* Schultze.

Acervulina inhaerens Schultze, 1854, Organ. des Polythal., p. 68, pl. vi, fig. 12.
Gypsina inhaerens (Schultze). Brady, 1884, p. 718, pl. cii, figs. 1–6.
Acervulina inhaerens Schultze. Cushman, 1918 etc. (1931), p. 134, pl. xxv, fig. 2 ; Parr, 1950, p. 368.

Occasional specimens were found in most of the samples of groups 1, 2 and 3.

Subfamily Gypsininae.

Genus *Gypsina* Carter, 1877.

(379) *Gypsina vesicularis* (Parker and Jones).

Orbitolina vesicularis Parker and Jones, 1860, Ann. Mag. Nat. Hist., ser. 3, **6**, p. 31, no. 5.
Gypsina vesicularis (Parker and Jones). Carter, 1877*a*, p. 173.

This common coral-reef species occurred in most of the samples of groups 1, 2 and 3. Particularly well-preserved specimens were found in sample 38.

(380) *Gypsina fimbriata* (Chapman).

(Plate V, figs. 14*a*, *b*.)

Planorbulina acervalis Brady var. *fimbriata* Chapman, 1900*a*, Journ. Linn. Soc., Zool. XXVIII, no. 181, p. 143, pl. 20, fig. 4.

Six specimens were found in sample 38. The test is circular, slightly concave below, campanulate above, with raised rounded centre and flattened periphery. The chambers of the body of the test are subpolygonal, bordered by a clear imperforate wall with papillose prominences at the junctions of polygons, and filled in with a thin perforate diaphragm, added alternately in adjacent chambers so that the surface of the test is on two levels. These chambers are slightly smaller than those of *G. vesicularis* which occurs in the same sample, but are otherwise clearly similar, and bear little resemblance to the inflated, coarsely perforate chambers of *Planorbulina acervalis*.

Fringing the periphery is an alternating series of elongate, subrectangular chambers, with imperforate wall and perforate diaphragm, differing only in size and shape from the other chambers. These fringing chambers occasionally anastomose or fork at the extremity, and are normally separated by a space which will be filled by the next-formed series. The upper surface of the test is brownish, the fringing chambers and the surface layer on the underside being glass-clear. Diameter *ca.* 1 mm.

From Chapman's figures and description, this is evidently the form he had from Funafuti. At first sight the fringing series of chambers suggests relationship with *Planorbulinella*, but there are no special apertures in these chambers, and in all other respects the species is a typical *Gypsina*. Chapman's illustrated specimen appears somewhat eroded, which may account for its reference to *Planorbulina*.

Genus *Sphaerogypsina* Galloway.

(381) *Sphaerogypsina globulus* (Reuss).

Ceriopora globulus Reuss, 1847, Haidinger's Naturw. Abhandl. II, p. 33, pl. v., fig. 7.
Gypsina globulus (Reuss). Brady, 1884, p. 717, pl. cl., fig. 8.
Sphaerogypsina globulus (Reuss). Galloway, 1933, p. 309, pl. 28, figs. 13, 14.

Occurs with *G. vesicularis* in the samples of groups 1, 2 and 3, with particularly good specimens in sample 38.

Genus *Planogypsina* Bermudez, 1952.

(382) *Planogypsina squamiformis* (Chapman).

Gypsina vesicularis Parker and Jones var. *squamiformis* Chapman, 1901, Journ. Linn. Soc., Zool. XXVIII, p. 200, pl. 19, figs. 15*a*, *b*.
Planogypsina squamiformis (Chapman). Bermudez, 1952, p. 124, pl. xxiv, fig. 15.

One specimen from sample 38 agrees with Chapman's diagnosis. The chambers are acervuline, in one plane, with a thin wall and slightly inflated perforate diaphragm. On the underside the trochospiral early stage, coloured brown, is clearly visible. The specimen is 1·2 mm. in diameter, but the periphery is broken all round and it is evidently part of a larger specimen.

Genus *Carpenteria* Gray, 1858.

(383) *Carpenteria monticularis* Carter.

Carpenteria monticularis Carter; 1877B, Ann. Mag. Nat. Hist. **4**, p. 14, pl. xiii, figs. 9.12 ; Brady, 1884, p. 677, pl. xcix, figs. 1–5.

A few specimens, adherent to calcareous algae, were found in the samples of group 3, wherever bottom conditions favoured the growth of sessile forms, particularly in sample 29.

Genus *Homotrema* Hickson, 1911.

(384) *Homotrema rubrum* (Lamarck).

Millepora rubra Lamarck, 1816, Hist. Nat. Anim. sans Vert., p. 202.
Homotrema rubrum (Lamarck). Hickson, 1911, Trans. Linn. Soc. London, Zool., ser. 2, **14**, pp. 445–447, pls. 30–32 ; Emiliani, 1951, pp. 143–147, pls. 15, 16 (synonymy).

Occasional fragments were found in the coarser coral-sand residues of samples of groups 1, 2 and 3.

Genus *Miniacina* Galloway, 1933.

(385) *Miniacina miniacea* (Pallas) subsp. *alba* (Carter).

Polytrema miniaceum (Pallas) var. *album* Carter, 1877*b*, Ann. Mag. Nat. Hist., ser. 4, XIX, p. 213, pl. xiii, fig. 14 ; Brady, 1884, p. 721, pl. cl, figs. 2, 3.

Occasional specimens were found in the coarser residues, particularly in sample 29.

Family NUMMULITIDAE.

Subfamily NUMMULITINAE.

Genus *Operculina* d'Orbigny, 1826.

(386) *Operculina ammonoides* (Gronovius).

Nautilus ammonoides Gronovius, 1781, Zooph. Gron. exh. Anim. Quadr., Leyden, p. 282, pl. xix, figs. 5, 6.
Operculina ammonoides (Gronovius). Carpenter, Parker and Jones, 1862, p. 810 ; Chapman and Parr, 1938, p. 290, pl. xvii, figs. 12–16, text-fig. 5 (synonymy).

This is the commoner of the two species present in the samples, and is frequent in most of the samples of groups 1, 2 and 3.

(387) *Operculina bartschi* Cushman.

O. bartschi Cushman, 1921, U.S. Nat. Mus. Bull. **100**, p. 376, text-fig. 13 ; Chapman and Parr, 1938, p. 292, pl. xvii, figs. 17–20, text-fig. 6.

Material dredged from Linden Bank (samples 31, 32 and 33) yielded a series of complanate and expanded specimens which are referred to the above species. No 31 contained three very large specimens averaging about 2 cm. in diameter and no. 33 had one broken specimen which had been in the same size range ; in no. 32 the specimens did not exceed 6 mm. An example of each type was sectioned, with the following result :

	Small form.	Large form.
Diameter of proloculus	0·04 mm.	0·02 mm.
Maximum diameter of test	5·3 mm.	19·0 mm.
Number of whorls	4	6½
Number of chambers in last whorl	27	38
Total number of chambers	57	140

The specimens thus fall into the normal pattern of alternation of generation, with the microspheric form larger and having more chambers than the megalospheric form. Relative abundance could not be ascertained, as the specimens came from different samples, both of which had apparently been fractioned, no. 31 containing only very large forms, and no. 32 containing nothing larger than 5–6 mm., while no. 33 contained only one broken specimen of the larger form and two of the smaller.

The external characters are those of *O. bartschi* Cushman. In both forms the central portion is thickened, convex and beaded, while the later whorls are thin, complanate and comparatively smooth. Beading in the large specimens is confined to the earlier whorls, the last whorl being smooth. The smaller specimens are beaded throughout, some specimens having the more prominent beading along the sutures, others in a row along the middle of the chamber between the sutures. A strong rounded keel is present, and the larger specimens are somewhat warped out of plane.

Sutures are highly recurved and somewhat wavy and irregular in the later whorls. Some specimens of the smaller form show regular thickenings of the outer face of the septum, marked also by a local widening of the septal canal and suggesting incipient chamberlet growth. They do not, however, amount to partial septation as recorded by Chapman and Parr for *O. complanata* Defrance.

Genus *Operculinella* Yabe, 1918.

388. *Operculinella venosa* (Fichtel and Moll).

Nautilus venosus Fichtel and Moll, 1798, Test. Micr., p. 59, pl. 8, figs. *e–h*.
Operculinella venosa (Fichtel and Moll). Cushman, 1924, p. 50, pl. 17, fig. 7 : Chapman and Parr, 1938, p. 293, pl. xlvii, figs. 21, 22, text-fig. 7 (synonymy).

Well-developed specimens including the evolute microspheric form were common in many of the samples of group 3. Said (1949) has identified " *Nautilus* " *venosus* Fichtel and Moll as a species of *Amphistegina*, rather than of *Operculinella* as considered by Cushman and later authors. Fichtel and Moll's fig. " *f* ", pl. 8, which shows only one side of the test, could be taken as representing either the dorsal view of *Amphistegina* or one side of the symmetrical *Operculinella*. In the present material there are specimens, considered to be the megalospheric form of *Amphistegina radiata*, which correspond as closely to fig. " *f* " as do other specimens to fig. " *b* ", of " *Nautilus* " *radiatus* on the same plate, suggesting that *venosa* may be a junior synonym of *A. radiata*. While there is apparently some doubt of the status of " *Nautilus* " *venosus*, it appears to the author that there is as yet insufficient evidence to justify any re-naming of the present species.

Subfamily HETEROSTEGININAE.

Genus *Heterostegina* d'Orbigny, 1826.

389. *Heterostegina suborbicularis* d'Orbigny.

Heterostegina suborbicularis d'Orbigny, 1826, Ann. Sci. Nat. VII, p. 305 ; Hofker, 1927, p. 70, pls. xxxv, xxxvi, figs. 3, 6–12 (synonymy).

This widely-distributed species is well represented in most of the samples of group 3, but does not occur in the reef collections nor in the two deeper-water samples.

390. *Heterostegina operculinoides* Hofker.

Heterostegina operculinoides Hofker, 1927, Foram. Siboga Exped., pt. 1, p. 67, pls. xxxiv, xxxvi, figs. 1, 2, 4, 5.

Six specimens from sample 46 are referable to this species, the two largest being *ca.* 7 mm. in diameter. The tests are thin, complanate and evolute, only the first few chambers being thickened to form a small raised and beaded boss. The sutures of the early whorls are beaded and limbate, the beading becoming less prominent in the later whorls. The radial sutures of the chamberlets are also limbate, but not so strongly as the septal sutures, so that the surfaces of the chamberlets appear as depressed rectangular areas. The form of the chamberlets is characteristic, being long and narrow, this character being assumed in the earliest whorls. Only the form regarded by Hofker as megalospheric was found.

This sample apparently derives from a plankton net which bottomed at 205 metres. In this area, therefore, *H. operculinoides* appears to be confined to the deeper waters of the continental shelf, whi.e *H. suborbicularis* represents the genus in shallower water.

Genus *Cycloclypeus* Carpenter, 1856.

(391) *Cycloclypeus carpenteri* Brady.

Cycloclypeus carpenteri Brady, 1881, Quart. Journ. Micr. Sci. XXI, p. 67 ; Chapman, 1900, p. 22, pl. 2, figs. 6, 7, pl. 3, figs. 1–5.

One specimen of the megalospheric form (= *C. guembelianus* Brady) was found in sample 46. The records show that this species is confined to the deeper off-shore waters, and it did not occur in any other sample.

PREVIOUS WORK IN THE REGION.

Up to the time of the voyage of the " Challenger ", comparatively little intensive study was made of the Barrier Reef foraminiferal fauna. Parker and Jones had described species from " Australian coral reefs ", and the researches of Carpenter into the detailed morphology of the larger tropical foraminifera are of considerable importance. Unfortunately the " Challenger " collections were confined to the Torres Strait islands. Nevertheless the records then made have been very relevant to the present work, particularly those from Raine Island.

Since the " Challenger " report, only short papers giving faunal lists or dealing with particular species have been published. Jensen (1905) listed foraminifera from Palm and Lizard Islands and described new species. Jensen and Goddard (1907) listed species from Townsville. Chapman (1898) described *Haddonia* from Torres Straits, (1908) recorded dimorphism in *Alveolinella* from Cairns Reef, and (1931) reported on bore samples from Michaelmas Reef. Chapman and Parr (1938) studied the species of *Operculina* and *Operculinella* occurring in the region. Cushman has described new species from the area and (1942) reported on a boring at Heron Island. Cushman and McCulloch (1940, 1942 and 1950) have described new species from West Molle Island, collected by the Allan Hancock Pacific Expeditions.

Parr has from time to time and in the course of other work referred to and resolved many questions of nomenclature in the case of Barrier Reef species, and in his last work (1950) recorded many species as ranging from Tasmania to North Queensland. He erected the genus *Torresina* (1947) to receive a new species from Torres Straits. In general, the foraminifera of this region have been more closely studied than those of the subtropical waters of southern Queensland and New South Wales.

ZOOGEOGRAPHICAL RELATIONSHIPS.

The shallow-water assemblages of the Barrier Reef, as might be expected, show a close relationship with faunas recorded for other locations in the tropical Indo-Pacific, ranging from the east coast of Africa to the islands of the central Pacific and including the Malay Archipelago. There is also a relationship with the raised beaches and shallow-water deposits of the warm phases of the Quaternary in southern Australia, when *Marginopora complanata* flourished as far south as Yorke Peninsula, and other tropical forms penetrated as far as the south coast of Victoria. A further relationship is to be noticed in the tendency for shallow-water tropical species to be represented by a closely-related cool-water form in south-east Australian waters, as in the case of *Discorbis subvesicularis* n. sp. and the well-known *D. dimidiatus* Parker and Jones.

Deeper-water assemblages include many species recorded from Victorian and Tasmanian waters by Chapman, Parr and others, indicating the existence of an eastern Australian continental-shelf fauna which requires much more study before its composition and north-south distribution will be fully understood. This relationship is brought out to some extent by Parr (1950) in recording species from off Tasmania and from the Great Australian Bight and noting their occurrence in Queensland waters.

The present collections throw some light on the northward distribution of previously-known cool-water forms, but much more work in this direction is needed, particularly in the New South Wales and South Queensland coastal waters, from which foraminiferal records are scanty. Greater knowledge of the climatic and depth distribution of recent foraminifera in these areas is needed for the fuller understanding of such factors in relation to Quaternary palaeoecological and climatic studies in southern Australia.

DEPTH INDICATIONS IN RELATION TO REEF BORINGS.

The results of this work have been considered in regard to the light they may throw on problems of reef-building, such as those raised by the Great Barrier Reef bores, 1926 and 1937 (Reports of the Great Barrier Reef Committee, vol. v, 1942). Cushman (*ibid.*, p. 112) suggests that where mixed assemblages of worn larger shallow-water foraminifera and smaller well-preserved deeper-water species occur, greater weight is to be given to the deeper-water specimens in determining the living fauna and hence the probable depth during deposition.

Richards and Hill (*ibid.*, p. 68) draw the inference from Cushman's determinations that, if the above conclusions are correct, alternating shallow and deep-water conditions must have occurred in the area of these bores, and state further that no evidence has been found in favour of such a history, the evidence of the mollusca being definitely at variance with it. Later, the authors state their opinion that the deeper-water types of foraminifera recognized by Cushman have been washed into the shallow shore area and that their smaller size has protected them from wear.

The evidence of the present collections is decidedly in favour of the latter view. Wherever conditions of deposition on the reef-flat or mangrove-pool stations have allowed fine material to collect, such mixtures have been found. The smaller foraminifera include both pelagic and benthic species, the larger forms usually represented by worn specimens of *Baculogypsina*, *Calcarina*, *Marginopora* and *Amphistegina*, perhaps the most characteristic forms found in the coarse coral sands of the surf zone.

Larger foraminifera derived from dredgings a few fathoms deep in the immediate off-shore zone are usually well preserved, though eroded specimens are of course found occasionally. Where bottom sediments are coarse in nature, due to current-sorting, sessile organisms are found on the eroded tests of larger foraminifera. This is rare in littoral deposits, where wave-pounding wears down the tests before such organisms can get a hold. Erosion in the deeper-water specimens appears to have been caused by biological factors such as boring algae, since the tests tend to be rotten and fragmentary rather than smoothly worn down as in the surf zone.

A rough classification of depth indications connected with the state of erosion of tests is as follows :

Assemblage.	Indication.
(1) Larger tests only, *Baculogypsina* and *Marginopora* predominant, in various stages of surface wear and smoothing-off of detail	Surf zone.
(2) Mixture of larger tests as in (1) and smaller species in good condition, with some mud	Reef pools and areas of quiet deposition near shore.
(3) Larger tests only, *Operculina*, *Heterostegina* and *Operculinella* predominant, with a proportion rotten and fragmentary and serving as a base for sessile foraminifera and other organisms	Deeper waters off-shore, subject to current-scouring.
(4) Large assemblages of species of various sizes, including the more delicate calcareous and larger arenaceous forms, in fine-grained matrix.	Deeper off-shore waters, mud bottom.

The evidence of the present collections does not go much beyond this, but is sufficient to show that the conditions observed by Cushman in the Barrier Reef bores are more likely to indicate shallow-water or littoral deposition than deep-water deposits comparable with the depth of boring. The variations in assemblage with depth of bore do not necessarily mean varying depths of deposition. In shallow-water and littoral conditions, where the foraminiferal assemblage is largely a thanatocoenosis, current- and wave-sorting result in the accumulation of coarse or fine sediments in localities perhaps separated by only a few yards. Changes in local topography can result in similar variations occurring in vertical succession, giving very different assemblages by purely mechanical and accidental causes having no depth significance. To interpret such changes correctly requires consideration of the condition of tests, the presence or absence of sessile organisms and the nature of the matrix.

LIST OF LITERATURE.

BALKWILL, F. P. and MILLETT, F. W. 1884. The Foraminifera of Galway. Journ. Micr. 3, pp. 19–28, 78–90, pls. i–iv.

BANDY, O. L. 1952. The genotype of *Siphogenerina*. Contr. Cushman Found. Foram. Res. 3, pt. 1, pp. 17–18.

BATSCH, A. J. G. F. 1791. Sechs Kupfertafeln mit Conchylien des Seesandes. Jena.

BERMUDEZ, P. J. 1952. Estudio sistematico de los Foraminiferes Rotaliformes. Ministerio de Minas e Hidrocarburos, Venezuela, Boletin de Geologia, 2, No. 4, pp. 1–230, pls. 1–35.

BERTHELIN, G. 1878. Liste des Foraminifères receuilles dans la Baie de Bourgneuf et à Pornichet. 8vo. Nantes.

BLAINVILLE, H. M. D. DE. 1834. Manuel d'Actinologie ou de Zoophytologie, pp. 1–644, pls. i–c (in Atlas). Paris. Levrault.

BRADY, H. B. 1876. On some Foraminifera from the Loo Choo Islands. Proc. Roy. Irish Acad., ser. 2, 2, II, pp. 589–590.

—— 1877. Supplementary Note on the Foraminifera of the Chalk (?) of the New Britain Group. Geol. Mag., Dec., II, LV, pp. 534–536.

—— 1879 etc. Notes on some of the reticularian Rhizopoda of the "Challenger" Expedition. Quart. Journ. Micr. Sci., 1879, XIX, pp. 20–63, pls. iii–v; pp. 261–299, pl. viii; 1881, *ibid*, XXI, pp. 31–71.

—— 1882. Report on the foraminifera. *In* Tizard and Murray, Exploration of the Faroe Channel during the summer of 1880, in H.M.S. "Knight Errant", with subsidiary reports. Proc. Roy. Soc.. Edinburgh, II (1880–82), pp. 708–717, pl. vi.

—— 1884. Report on the foraminifera dredged by H.M.S. "Challenger" during the years 1873–76. "Challenger" Exped. Repts., Zool. 9, 2 vols., text and pls.

—— 1890. Note on a new type of foraminifera of the family Chilostomellidae. Journ. Roy. Micr. Soc., 1890, pp. 567–571, text-fig.

—— PARKER, W. K. and JONES, T. R. 1870. A monograph of the genus *Polymorphina*. Trans. Linn. Soc., London, XXVII, (2), pp. 197–253, pls. xxxix–xlii.

BROTZEN, F. 1948. The Swedish Paleocene and its Foraminiferal Fauna. Sver. geol. Unders., ser. C, No. 493, Arsbok 42, No. 2, pp. 1–140, pls. 1–19, text-figs. 1–41.

BUCHNER, P. 1940. Die Lagenen des Golfes von Neapel und der marinen Ablagerungen auf Ischia. Nova Acta Leopoldina. Abh. K. Leopoldinisch-Carolinisch Deutschen Akad. der Naturf. N.F., Bd. 9, No. 62, pp. 363–560, Taf. i–xxix.

BURROWS, H. W. and HOLLAND, R. 1895. *In* Jones, Parker and Brady (T. R. Jones). A monograph of the Foraminifera of the Crag, Part II. Pal. Soc. Mon., London, pp. 73–210, pls. 5–7.

CARPENTER, W. B. 1861. Researches on the Foraminifera. Phil. Trans. 150, pp. 535–586, pls. xvii–xxii.

—— PARKER, W. K. and JONES, T. R. 1862. Introduction to the Study of the Foraminifera. Ray Soc., London.

CARTER, H. J. 1877. Description of a new species of Foraminifera (*Rotalia spiculotesta*). Ann. Mag. Nat. Hist., ser. 4, XX, pp. 470–473, pl. xvi.

—— 1877*a*. On a Melobesian form of Foraminifera (*Gypsina melobesoides* mihi); and further observations on *Carpenteria monticularis*. Ann. Mag. Nat. Hist., ser. 4, XX, pp. 172–176.

—— 1877*b*. On the locality of *Carpenteria balaniformis*, with Description of a new Species, and other Foraminifera found in and about *Tubipora musica*. Ann. Mag. Nat. Hist., ser. 4, XIX, pp. 209–219, pl. xii.

CHAPMAN, F. 1898. On *Haddonia*, a new Genus of the Foraminifera from Torres Straits. Journ. Linn. Soc., Zool. XXVI, pp. 452–456, pl. 28.

—— 1900. On some New and Interesting Foraminifera from the Funafuti Atoll, Ellice Islands. Journ. Linn. Soc., Zool., XXVIII, pp. 1–27, pls. 1–4.

—— 1900*a*. Foraminifera from the Lagoon at Funafuti. Journ. Linn. Soc., Zool., XXVIII, pp. 161–210, pls. 19, 20.

—— 1901. On the Foraminifera collected around the Funafuti Atoll from Shallow and Moderately Deep Water. Journ. Linn. Soc., Zool., XXVIII, pp. 379–417, pls. 35, 36.

—— 1908. On Dimorphism in the Recent Foraminifer, *Alveolina boscii* Defr. sp. Journ. Roy. Micr. Soc. for 1908, pp. 151–153, pls. ii, iii, text-fig.

—— 1909. Recent Foraminifera of Victoria : Some Littoral Gatherings. Journ. Quekett Micr. Club, ser. 2, 10, pp. 117–146, pls. 9, 10.

—— 1910. On the Foraminifera and Ostracoda from Soundings (Chiefly Deep-water) collected round Funafuti by H.M.S. " Penguin ". Journ. Linn. Soc., Zool., XXX, pp. 387–444, pls. 54–57.

—— 1915. Report on the Foraminifera and Ostracoda obtained by the F.I.S. " Endeavour " from the east coast of Tasmania and off Cape Wiles, South Australia. Australia, Dept. Trade and Customs, Fisheries, Zool. (Biol.) Results, 3 (1), pp. 3–51, pls. i–iii.

—— 1931. A Report on Samples obtained by Boring into Michaelmas Reef, about 22 miles N.E. of Cairns, Queensland. Great Barrier Reef Committee, Repts. III, pp. 32–42, pls. ix, x.

—— 1941. Report on Foraminiferal Soundings and Dredgings of the F.I.S. " Endeavour " along the Continental Shelf of the S.E. Coast of Australia. Trans. Roy. Soc. S. Aust., 65 (2), pp. 145–211, pls. vii–ix.

—— and PARR, W. J. 1935. Foraminifera and ostracoda from soundings made by the trawler " Bonthorpe " in the Great Australian Bight. Journ. Roy. Soc. W. Aust. 21 (1934/35) pp. 1–6, pl. 1.

—— —— 1937. Aust. Antarctic Exped. 1911–14, Sci. Repts., Ser. C, Zool. and Bot. 1, part ii, Foraminifera, pp. 1–190, pls. viii–x.

—— —— 1938. Australian and New Zealand Species of the Foraminiferal Genera *Operculina* and *Operculinella*. Proc. Roy. Soc. Victoria, 50, part 1, pp. 279–299, pls. xvi, xvii.

CHASTER, G. W. 1892. Report upon the Foraminifera of the Southport Society of Natural Science District. Southport Soc. Nat. Sci. 1, pp. 54–71, pl. 1.

COLLINS, A. C. 1953. Pleistocene Foraminifera from Port Fairy, Western Victoria. Mem. Nat. Mus. Victoria., Melbourne, 18, pp. 93–105, pl. 1.

COSTA, O. G. 1856. Paleontologia del Regno di Napoli, parti 2. Atti Accad. Pont. VII, pp. 145–378, pls. ix–xxvii.

CUSHMAN, J. A. 1910 etc. A monograph of the foraminifera of the North Pacific Ocean. Smithsonian Inst., U.S. Nat. Mus. Bull. 71, pt. 1, 1910 ; pt. 2, 1911 ; pt. 3, 1913, pt. 4, 1914 ; pt. 5, 1915, pt. 6, 1917.

—— 1910*a*. New Arenaceous Foraminifera from the Philippines. Proc. U.S. Nat. Mus. 38, No. 1759, pp. 437–442, text-figs. 1–19.

—— 1913. New Textulariidae and other Arenaceous Foraminifera from the Philippine Islands and contiguous waters. Proc. U.S. Nat. Mus. 44, No. 1973, pp. 633-638, pls. 78–80.

—— 1918 etc. The foraminifera of the Atlantic Ocean. Smithsonian Inst., U.S. Nat. Mus. Bull. 104, pt. 1, 1918 ; pt. 2, 1920 ; pt. 3, 1922 ; pt. 4, 1923, pt. 5, 1924 ; pt. 6, 1929, pt. 7, 1930, pt. 8, 1931.

—— 1918*a*. Foraminifera from Murray Island, Australia. Publ. 213, Carnegie Instit. Washington, pp. 289, 290, pl. 96.

—— 1919. Recent foraminifera from off New Zealand. Proc. U.S. Nat. Mus. 56, No. 2302, pp. 593–640, pls. lxxiv–lxxv.

—— 1919*a*. The relationships of the genera *Calcarina, Tinoporus* and *Baculogypsina* as indicated by recent Philippine material. U.S. Nat. Mus. Bull. 100, 1, pt. 6, pp. 363–368, pls. 44, 45.

—— 1921. Foraminifera of the Philippine and adjacent seas. U.S. Nat. Mus. Bull. 100, pt. 4, pp. pp. 1–608, pls. 1–xcix.

—— 1922. Shallow-water foraminifera of the Tortugas region. Publ. 311, Carnegie Instit. Washington, XVII, pp. 1–85, pls. 1–14.

—— 1924. Samoan Foraminifera. Publ. 342, Carnegie Instit. Washington, pp. 3–75, pls. 1–25.

—— 1925. Foraminifera of the Tropical Central Pacific. Bernice P. Bishop Mus. Bull. 27, pp. 121–144.

—— 1926. Foraminifera of the genera *Siphogenerina* and *Pavonina*. Proc. U.S. Nat. Mus. 67, Art. 25, pp. 1–24, pls. 1–6.

—— 1926*a*. The genus *Chilostomella* and Related Genera. Contr. Cushman Lab. Foram. Res. 1, pt. 4, pp. 73–80, pl. 11.

CUSHMAN, J. A. 1926*b*. Recent Foraminifera from Porto Rico. Publ. 344, Carnegie Instit. Washington, pp. 73–84, pl. 1.

—— 1926*c*. The genus *Lamarckina* and its American species. Contr. Cushman Lab. Foram. Res. 2, pt. 1, pp. 7–14, pl. 1 (in part).

—— 1927. Recent Foraminifera from off the West Coast of America. Bull. Scripps Instit. Oceanogr., Tech. Ser. 1, No. 10, pp. 114–188, pls. 1–6.

—— 1927*a*. An outline of a reclassification of the Foraminifera. Contr. Cushman Lab. Foram. Res. 3, pt. 1, pp. 1–105, pls. 1–21.

—— 1927*b*. Foraminifera of the genus *Siphonina* and related genera. Proc. U.S. Nat. Mus. 72, Art. 20, pp. 1–15, pls. 1–4.

—— 1928. Fistulose species of *Gaudryina* and *Heterostomella*. Contr. Cushman Lab. Foram. Res. 4, pt. 4, pp. 107–112, pl. 16.

—— 1928*a*. Additional genera of the foraminifera. Contr. Cushman Lab. Foram. Res. 4, pt. 1, pp. 1–8.

—— 1929. The genus *Bolivinella* and its species. Contr. Cushman Lab. Foram. Res. 5, pt. 2, pp. 28–34, pl. 5.

—— 1931. *Parrina*, a new generic name. Contr. Cushman Lab. Foram. Res. 7, pt. 1, pp. 17, 18, pl. 3 (in part).

—— 1931*a*. Two new foraminiferal genera from the South Pacific. Contr. Cushman Lab. Foram. Res. 7, pt. 4, pp. 78–82, pl. 10 (in part).

—— 1932 etc. The foraminifera of the tropical Pacific collections of the " Albatross ", 1899–1900 : U.S. Nat. Mus. Bull. 161, pt. 1, 1932 ; pt. 2, 1933, pt. 3, 1942.

—— 1933. Some new foraminiferal genera. Contr. Cushman Lab. Foram. Res., 9, pt. 1, pp. 21, 22.

—— 1933*a*. Some new Recent Foraminifera from the Tropical Pacific. Contr. Cushman Lab. Foram. Res. 9, pt. 4, pp. 77–95, pls. 8–10.

—— 1934. A Recent *Gumbelitria* ? from the Pacific. Contr. Cushman Lab. Foram. Res. 10, pt. 4, p. 105, pl. 13 (in part).

—— 1934*a*. Notes on the genus *Tretomphalus* with descriptions of some new species and a new genus *Pyropilus*. Contr. Cushman Lab. Foram. Res. 10, pt. 4, pp. 79–101, pls. 11, 12, 13 (in part).

—— 1936. New genera and species of the families Verneuilinidae and Valvulinidae and of the subfamily Virgulinidae. Sp. Publ. No. 6, Cushman Lab. Foram. Res., pp. 1–71, pls. 1–8.

—— 1936*a*. Some new species of *Elphidium* and related genera. Contr. Cushman Lab. Foram. Res. 12, pt. 4, pp. 77–89, pl. 13 (in part), 14, 15.

—— 1937. A monograph of the foraminiferal family Verneuilinidae. Sp. Publ. No. 7, Cushman Lab. Foram. Res., pp. i–xiii, 1–157, pls. 1–20.

—— 1937*a*. A monograph of the foraminiferal family Valvulinidae. Sp. Publ. No. 8, Cushman Lab. Foram. Res., pp. i–xiii, 1–210, pls. 1–24.

—— 1937*b*. A monograph of the subfamily Virgulininae of the foraminiferal family Buliminidae. Sp. Publ. No. 9, Cushman Lab. Foram. Res., pp. i–xv, 1–228, pls. 1–24.

—— 1939. A monograph of the foraminiferal family Nonionidae. U.S. Geol. Survey Prof. Paper 191, pp. 1–100, pls. 1–20.

—— 1942. A report on samples obtained by the boring on Heron Island, Great Barrier Reef, Australia. Reports of the Great Barrier Reef Committee, V, Appx. 1, pp. 112–119, pls. 11–12.

—— 1944. The genus *Articulina* and its species. Sp. Publ. No. 10, Cushman Lab. Foram. Res., pp. 1–21, pls. 1–4.

—— 1944*a*. Foraminifera from the shallow water of the New England coast. Sp. Publ. No. 3, Cushman Lab. Foram. Res., pp. 1–37, pls. 1–4.

—— 1945. The species of the subfamily Réussellininae of the foraminiferal family Buliminidae : Contr. Cushman Lab. Foram. Res. 21, pt. 2, pp. 23–54.

—— 1946. The genus *Sigmoilina* and its species. Contr. Cushman Lab. Foram. Res. 22, pt. 2, pp. 29–45, pls. 5, 6.

—— 1946*a*. The genus *Hauerina* and its species. Contr. Cushman Lab. Foram. Res. 22, pt. 1, pp. 2–15, pls. 1 (in part), 2.

—— 1946*b*. *Polysegmentina*, a new genus of the Opthalmidiidae. Contr. Cushman Lab. Foram. Res. 22, pt. 1, p. 1, pl. 1 (in part).

CUSHMAN, J. A. and BERMUDEZ, P. J. 1949. Some Cuban species of *Globorotalia*. Contr. Cushman Lab. Foram. Res. 25, pt. 2, pp. 26–45, pls. 5–8.

CUSHMAN, J. A. and GRAY, H. B. 1946. Some new species and varieties of Foraminifera from the Pliocene of Timms Point, California. Contr. Cushman Lab. Foram. Res. 22, pt. 2, pp. 65–69, pl. 12.

CUSHMAN, J. A. and MCCULLOCH, I. 1939. A Report on some Arenaceous Foraminifera. Allan Hancock Pacific Exped. 6, No. 1, pp. 1–113, pls. 1–12.

—— —— 1940. Some Nonionidae in the collections of the Allan Hancock Foundation. Allan Hancock Pacific Exped. 6, No. 3, pp. 145–178, pls. 17–20.

—— —— 1942, Some Virgulininae in the collections of the Allan Hancock Foundation. Allan Hancock Pacific Exped. 6, No. 4, pp. 181–230, pls. 21–28.

—— —— 1948. The Species of *Bulimina* and related genera in the collections of the Allan Hancock Foundation. Allan Hancock Pacific Exped. 6, No. 5, pp. 231–294, pls. 29–36.

—— —— 1950. Some Lagenidae in the collections of the Allan Hancock Foundation. Allan Hancock Pacific Exped. 6, No. 6, pp. 295–364, pls. 37–48.

CUSHMAN, J. A. and PARKER, F. L. 1931. Recent Foraminifera from the Atlantic Coast of South America. Proc. U.S. Nat. Mus. 80, Art. 3, pp. 1–24, pls. 1–4.

—— —— 1947. *Bulimina* and related foraminiferal genera. U.S. Geol. Survey Prof. Paper 210–D, pp. 55–176, pls. 15–30.

CUSHMAN, J. A. and TODD, M. R. 1941. Notes on the species of *Uvigerina* and *Angulogerina* described from the Pliocene and Pleistocene. Contr. Cushman Lab. Foram. Res. 17, pt. 3, pp. 70–78, pls. 17–20.

—— —— 1942. The genus *Cancris* and its species. Contr. Cushman Lab. Foram. Res. 18, pt. 4, pp. 72–94, pls. 17–24.

—— —— 1943. The genus *Pullenia* and its species. Contr. Cushman Lab. Foram. Res. 19, pt. 1, pp. 1–23, pls. 1–4.

—— —— 1944. The genus *Spiroloculina* and its species. Sp. Publ. No. 11, Cushman Lab. Foram. Res., pp. 1–82, pls. 1–9.

—— —— 1944*a*. Species of the genera *Nodopthalmidium*, *Nodobaculariella* and *Vertebralina*. Contr. Cushman. Lab. Foram. Res. 20, pt. 3, pp. 64–77, pls. 11–12.

CUSHMAN, J. A. and OZAWA, Y. 1930. A Monograph of the Foraminiferal Family Polymorphinidae, Recent and Fossil. Proc. U.S. Nat. Mus. 77, Art. 6, pp. 1–185, pls. 1–40.

DOUVILLÉ, H. 1906. Les calcaires à Fusulines de l'Indochine. Bull. Soc. Géol. France, ser. 4, 6, pp. 576–587, pls. xvii, xviii.

EARLAND, A. 1933. Foraminifera ; Part II, South Georgia. " Discovery " Repts., Cambridge, VII, pp. 27–138, pls. i–iv.

—— 1934. Foraminifera ; Part III, The Falklands Sector of the Antarctic (excluding South Georgia). " Discovery " Repts., Cambridge, X, pp. 1–208, pls. i–x.

EGGER, J. G. 1857. Die Foraminiferen der Miocän-Schichten bei Ortenburg in Nieder-Bayern. Neues Jahrb. für Min., Jahrg. 1857, pp. 266–311, pls. 5–15.

—— 1893. Foraminiferen aus Meersgrundproben, gelothet von 1874 bis 1876 von S. M. Sch. " Gazelle ". Abhandl. kön. bay. Akad. Wiss., München, Cl. II, 18, Abt. 2, pp. 195–458, 21 pls., 1 map.

EHRENBURG, C. G. 1843. Verbreitung und Einfluss des mikroscopischen Lebens in Sud- und Nord-Amerika. K. Akad. Wiss., Berlin, Physik Abh., Jarhrg., 1841, pp. 291–445, pls. i–iv.

—— 1854. Mikrogeologie. Leipzig, 2 vols. folio, 40 pls.

EIMER, G. H. T. and FICKERT, C. 1899. Die Artbildung und Verwandschaft bei den Foraminiferen. Zeitschr. Wiss. Zool., Leipzig, 65, pp. 599–708, text-figs. i–xlv.

EMILIANI, C. 1951. On the species *Homotrema rubrum* (Lamarck). Contr. Cushman Found. Foram. Res. II, pt. 4, pp. 143–147, pls. 15–16, fig. 1.

FICHTEL, L. v. and MOLL, J. P. C. v. 1798. Testacea microscopica aliaque minuta ex generibus Argonauta et Nautilus ad naturam delineata et descripta. Vienna.

FINLAY, H. J. 1939 etc. New Zealand Foraminifera : Key Species in Stratigraphy. No. 1, Trans. Roy. Soc. New Zealand, 68, (1939), pp. 504–533, pls. 68, 69 ; No. 2, l. c., 69, (1939), pp. 89–128, pls. 11–14 ; No. 3, l. c., pp. 309–329, pls. 24–29 ; No. 4, l. c., 69, (1940), pp. 448–472, pls. 62–67.

FLINT, J. M. 1899. Recent Foraminifera. A descriptive catalogue of specimens dredged by U.S. Fish Commission Steamer " Albatross ". U.S. Nat. Mus., Ann. Rept., 1897, pt. 1, pp. 249–349, pls. i–lxxx.

FORNASINI, C. 1900. Le Polymorphine e le Uvigerine fossili d'Italia. Boll. Soc. Geol. Ital. 19, pp. 132–172, 7 figs.

—— 1902. Intorno a la nomenclatura di alcuni nodosaridi neogenici italiani. Mem. Accad. Sci. Istit. Bologna, 9 (1901), pp. 45–76, 27 text-figs.

FORSKÅL, P. 1775. Descriptiones Animalium, etc. 4to, Copenhagen.

FRIZZELL, D. L. and SCHWARTZ, E. 1950. A new Lituolid Foraminiferal Genus from the Cretaceous, with an emendation of *Cribrostomella* Cushman. Univ. Missouri, School of Mines and Metallurgy, Tech. Ser., Bull. 76, pp. 1–12, pl. 1, text-fig. 1.

Galloway, J. J. 1933. A Manual of Foraminifera. 4to, Bloomington, Indiana ; pp. i–xii, 1–483, 42 pls.

—— and Morrey, M. 1929. A Lower Tertiary Foraminiferal Fauna from Manti, Ecuador. Bull. Amer. Pal. XV, No 55, pp. 7–56, pls. i–vi.

Glaessner, M. 1937. On a New Family of Foraminifera. Studies in Micropaleontology, 1, fasc. 3, pp. 19–29, pls. i, ii.

—— 1947. Principles of Micropalaeontology. 4to, Melbourne, pp. i–xvi, 1–297, 14 pls., 7 tables, 64 text-figs.

Goddard, E. J. and Jensen, H. I. 1907. Contributions to a knowledge of Australian foraminifera, Part II. Proc. Linn. Soc. New South Wales, 32, pp. 281–318, pl. vi.

Gronovius, L. T. 1781. Zoophylacium Gronovianum etc. Leyden.

Hada, Y. 1931. Report of the Biological Survey of Mutsu Bay. 19. Notes on the Recent Foraminifera from Mutsu Bay. Sci. Repts. Tohoku Imp. Univ., 4th Ser., Biol. VI, No. 1, pp. 45–148, text-figs. 1–95.

Heron-Allen, E. and Earland, A. 1913. On some Foraminifera from the North Sea, dredged by the Fisheries Cruiser " Goldseeker "; No. 3. Journ. Roy. Micr. Soc. for 1913, pp. 272–276, pl. xi.

—— —— 1913*a*. Clare Island Survey, pt. 64, Foraminifera. Proc. Roy. Irish Acad. XXXI, sect. 3 (1911–15), pp. 1–188, pls. i–xiii.

—— —— 1914 etc. The Foraminifera of the Kerimba Archipelago (Portuguese East Africa). Trans. Zool. Soc. London, 20, pt. 1, 1914, pp. 363–390, pls. xxxv–xxxvii ; pt. 2, 1915, pp. 543–794, pls. xl–liii.

—— —— 1922. Protozoa, Part II, Foraminifera. Brit. Antarctic (Terra Nova) Exped., 1910, Nat. Hist. Repts., Zool. 6 (2), pp. 25–268, pls. i–viii.

—— —— 1924. The Foraminifera of Lord Howe Island, South Pacific. Journ. Linn. Soc., Zool. 35, pp. 599–647, pls. 35–37.

—— —— 1924*a*. The Miocene Foraminifera of the " Filter Quarry ", Moorabool River, Victoria, Australia. Journ. Roy. Micr. Soc., 1924, pp. 121–186, pls. 7–14.

—— —— 1928. On the Pegididae, a New Family of Foraminifera. Journ. Roy. Micr. Soc. 48, pp. 283–299, 3 pls.

—— —— 1932. Foraminifera. Part 1. The ice-free area of the Falkland Islands and adjacent seas. " Discovery " Repts., Cambridge, 4, pp. 291–460, pls. vi–xvii.

Hickson, S J. 1911. On *Polytrema* and some allied genera. Trans. Linn. Soc. London., Zool., ser. 2, 14, 442–62, pls. 30–32.

Hofker, J., 1927. The Foraminifera of the Siboga Expedition. Part I. Monograph IV, Siboga Exped., Pt. I, pp. 1–78, pls. i–xxxviii, text-figs. 1–11.

—— 1951. The Foraminifera of the Siboga Expedition, Part III. Monograph IV*a*, Siboga Exped., pp. 1–508, text-figs. 1–348.

—— 1953. The genus *Epistomaria* Galloway 1933, and the genus *Epistomaroides* Uchio 1952. Paläont. Zeitschr., 27, Nos. 3/4, pp. 129–142, text-figs. 1–14.

Höglund, H. 1947. Foraminifera in the Gullmar Fjord and the Skagerrak. Zool. Bidr. från Uppsala, Bd. 26, pp. 3–328, pls. 1–32, text-figs. 1–312.

Howchin, W. and Parr, W. J. 1938. Notes on the Geological Features and Foraminiferal Fauna of the Metropolitan Abattoirs Bore, Adelaide. Trans. Roy. Soc. South Australia, 62 (2), pp. 287–317, pls. xv–xix.

Jensen, H. I. 1905. Contributions to a knowledge of Australian foraminifera ; Part I. Proc. Linn. Soc. New South Wales, 29 (1904), pt. 4, pp. 810–832, pl. xxiii.

Jones, F. W. O. Rymer. 1872. On some Recent forms of Lagenae from Deep-sea Soundings in the Java Sea. Trans. Linn. Soc. London, XXX, p. 45, pl. xix.

Jones, R. T. and Parker, W. K. 1860. On the Rhizopodal fauna of the Mediterranean, compared with that of the Italian and some other Tertiary deposits. Quart. Journ. Geol. Soc., XVI, pp. 292–307.

—— —— and Brady, H. B. 1866 etc. A Monograph of the foraminifera of the Crag. Palaeontogr. Soc., London, pt. 1, 1866, pp. 1–72 ; pt. 2, 1895, pp. 73–210, pt. 3, 1896, pp. 211–314 ; pt. 4, 1897, pp. 315–402.

Karrer, F. 1868. Die Miocene Foraminiferen-Fauna von Kostej im Banat. Sitz. Akad. Wiss. Wien, VIII, pp. 111–193, pls. i–v.

Lamarck, J. P. B. A. de. 1804 etc. Explication a des planches rélatives aux coquilles fossiles des environs de Paris. Ann. du Mus. (Paris), 5, 1804, pp. 179–180, 237–245, 349–357. Continued in vol. 8, 1806, pp. 383–387, pl. lxii, and vol. 9, pp. 236–240, pl. xvi.

—— 1816 etc. Histoire naturelle des Animaux sans Vertèbres. Paris, 2, 1816, pp. 193–197 ; 7, 1822, pp. 580–632.

LACROIX, E. 1938. Révision des genre *Massilina*. Bull. l'Inst. Océanogr. (Monaco), No. 754, pp. 1–11, text-figs. 1–9.

LALICKER, C. G. and MCCULLOCH, I. 1940. Some Textulariidae of the Pacific Ocean. Allan Hancock Pacific Exped. 6, No. 2, pp. 115–143, pls. 13–16.

LINNE, C. A. 1758. Systema Naturae, ed. 10. 8vo, Stockholm.

LOEBLICH, A. R. jun. and TAPPAN, H. 1953. Studies of Arctic Foraminifera. Smithsonian Misc. Coll. 121, No. 7, pp. 1–143, pls. 1–24, 1 text-fig.

—— —— 1954. Emendation of the foraminiferal genera *Ammodiscus* Reuss, 862, and *Involutina* Terquem, 1862. Journ. Washington Acad. Sci. 44, No. 10, pp. 306–310, text-figs. 1, 2.

MILLETT, F. W. 1898 etc. Report on the recent foraminifera of the Malay Archipelago contained in anchor-mud, collected by Mr. A. Durrand, F.R.M.S. Journ. Roy. Micr. Soc., 1898, pp. 258–269, 499–513, 607–614; 1899, pp. 249–255, 357–365, 557–564; 1900, pp. 6–13, 273–281, 539–549; 1901, pp. 1–11, 485–497, 619–628; 1902, pp. 509–528; 1903, pp. 253–275, 685–704; 1904, pp. 489–506, 597–609. 19 pls.

MONTAGUE, G. 1803–8. Testacea Britannica, or natural history of British shells. 3 vols., London, 1803. Supplement (pls.) 1808.

MONTFORT, D. DE. 1808. Conchyliologie Systematique et Classification Méthodique des Coquilles, etc. 2 vols. Paris. 1808–10.

MYERS, E. H. 1935. The Life History of *Patellina corrugata* Williamson, a foraminifer. Bull. Scripps Instit. Oceanogr., Tech. Ser. 3, pp. 355–392, pls. 10–16, 1 text-fig.

NORMAN, A. M. 1876. *In* Jeffries, Preliminary Report of the Biological Results of a Cruise in H.M.S. " Valorous " to Davis Strait in 1875. Proc. Roy. Soc. XXV, p. 202.

—— 1878. On the Genus *Haliphysema* ,with a description of several forms apparently allied to it. Ann. Mag. Nat. Hist., ser. 5, 1, p. 265, pl. xvi.

D'ORBIGNY, A. D. 1826. Tableau méthodique de la classe des Céphalopodes. Ann. Sci. Nat., Paris., ser. 1, 7, pp. 96–314, pls. x–xvii (in Atlas).

—— 1839. Voyage dans l'Amérique Méridional: Foraminifères. Strasbourg, P. Bertrand, 5, pt. 5, pp. 1–86, pls. i–ix.

—— 1839*a*. Foraminifères. *In* Sagra, R. de la, Histoire physique, politique et naturelle de l'île de Cuba, pp. 1–224 (plates published separately), Paris, A. Bertrand.

—— 1839*b*. Foraminifères des Iles Canaries. *In* Barker-Webb and Berthelot, Histoire Naturelle des Iles Canaries, Paris, Béthune, tome 2, pt. 2, Zool., pp. 119–146, pls. i–iii.

—— 1846. Foraminifères fossiles du bassin tertiare de Vienne (Autriche). Paris, Gide et Cie, pp. 1–303, pls. i–xxi.

OVEY, C. D. 1947. Note on the taxonomy of *Spirillina limbata* var. *denticulata* Brady. Journ. Micr. Soc. 67, pp. 17, 18.

PARKER, W. K. and JONES, T. R. 1860. On the nomenclature of the Foraminifera, IV, The Species enumerated by Lamarck. Ann. Mag. Nat. Hist. 6, pp. 29–40.

—— —— 1865. On some Foraminifera from the North Atlantic and Arctic Oceans, including Davis Straits and Baffin's Bay. Phil. Trans. Roy. Soc. 155, pp. 325–441, pls. xiii–xix.

—— —— and BRADY, H. B. 1865. On the nomenclature of the Foraminifera, XII. The Species enumerated by d'Orbigny in the Annales des Sciences Naturelles, vii, 1826, (3) The Species illustrated by Modèles. Ann. Mag. Nat. Hist. 16, pp. 15–41, pls. 1–3.

PARR, W. J. 1932. Victorian and South Australian Shallow-water Foraminifera; Part I. Proc. Roy. Soc. Victoria, XLIV (N.S.), pt. 1, pp. 1–14, pl. i; Part II, *ibid.*, XLIV (N.S.), pt. 2, pp. 218–234, pls. xxi, xxii.

—— 1939. Foraminifera of the Pliocene of South-Eastern Australia. Min. Geol. Journ., Victoria, 1, No. 4, pp. 65–71, 1 pl.

—— 1941. A New Genus, *Planulinoides*, and some Species of Foraminifera from Southern Australia. Min. Geol. Journ., Victoria, 2, No. 5, p. 315, text-fig.

—— 1943. *In* Cotton and Godfrey, 1943, A Systematic List of the Echinodermata, Foraminifera, Hydroida and Brachiopoda of Southern Australia. Publ. No. 3, Malac. Soc. South Australia, Adelaide.

—— 1945. Recent Foraminifera from Barwon Heads, Victoria. Proc. Roy. Soc. Victoria, 56 (N.S.), pt. 2, pp. 189–218, pls. viii–xii.

—— 1947. The Lagenid Foraminifera and their Relationships. Proc. Roy. Soc. Victoria, 58 (N.S.), pp. 116–130, pls. vi, vii.

—— 1947*a*. On *Torresina*, a new genus of the Foraminifera from Eastern Australia. Journ. Roy. Micr. Soc. LXIV, pp. 129–135, pl. i, text-figs. 1–3.

Parr, W. J. 1950. Foraminifera. B.A.N.Z. Antarctic Research Exped. 1929–31, Repts., Ser. B. (Zool. and Bot.) V, pt. 6, pp. 223–392, pls. iii–xv, text-figs. 1–8.

—— and Collins, A. C. 1930. Notes on Australian and New Zealand Foraminifera ; No. 1, The species of *Patellina* and *Patellinella,* with a description of a new genus *Annulopatellina.* Proc. Roy. Soc. Victoria, 43 (n.s.), pp. 89–95, pl. iv.

Reuss, A. E. 1847. *In* Haidinger's Naturw. Abhandl. 2.

—— 1850. Neue Foraminiferen aus dem Schichten des österreichischen Tertiärsbeckens. Denkschr. Akad. Wiss. Wien, 1, pp. 365–390, pls. 46–51.

—— 1851. Ueber die fossilen Foraminiferen und Entomostraceen der Septarienthon der Umgegend von Berlin. Zeitschr. deutsch. geol. Gesel. 3, pp. 49–92, pls. iii–vii.

—— 1863. Beiträge zur tertiären Foraminiferen-Fauna. Sitzungsb. d. k. Akad. Wiss. Wien, 48, pp. 36–69, pls. 1–8.

—— 1865. Die Foraminiferen, Anthozoen and Bryozoen des Deutsches Septarienthones. Denkschr. d. k. Akad. Wiss. Wien, XXV, pp. 117–214, pls. i–xi.

Rhumbler, L. 1903. Systematische Zusammenstellung der recenten Reticulosa. Arch. Protist., Jena, III, pp. 181–294.

—— 1906. Foraminiferen von Laysan und den Chatham Inseln. Zool. Jahrb., Abt. Syst., Jena, Bd. 24, pp. 21–80, taf. ii–v.

Sacco, F. 1893. Sur quelques Tinoporinae du Miocène de Turin. Soc. Belge. Geol., Pal. Hydr. Bull., Bruxelles, 7, fasc. 3.

Said, R. 1949. Foraminifera of the Northern Red Sea. Sp. Publ. 26, Cushman Lab. Foram. Res.

Schubert, R. 1907. Beiträge zu einer natürlichen Systematik der Foraminiferen. Neues Jahrb. für Min., 25, pp. 233–260, text-fig.

Schultze, M. S. 1854. Ueber den Organismus der Polythalamien (Foraminiferen), nebst Bermerkungen uber die Rhizopoden im allgemein. Fol., 7 pls., Leipzig.

Schwager, C. 1866. Fossile Foraminiferen von Kar-Nicobar. Novara Exped. 1857–59. Wien, Bd. 2, Geol. Theil, pp. 187–268, taf. iv–vii.

—— 1878. Nota su alcuni foraminiferi nuovi del tufo di Stretto presso Girgenti. Italy, Uff. Geol. (R. Comm. Geol. Ital.), Boll., col. 9, pp. 511–514, 519–529.

Seguenza, G. 1862. Dei terreni terziari del distretto di Messina ; Parti II—Descrizione dei foraminiferi monotalamica delle marne mioceniche del distretto di Messina. Messina, T. Capra, pp. 1–84, tav. i, ii.

—— 1880. Le Formazione Terziare nella Provincia di Reggio (Calabria). Atti Accad. Lincei, ser. 3, 6, pp. 1–446, pls. 1–17.

Sidebottom, H. 1904, etc. Report on the Recent Foraminifera from the coast of the Island of Delos (Grecian Archipelago). Mem. Proc. Manchester Lit. Phil. Soc., Part I (1904), xlviii, pt. II, no. 5 ; Part II (1905), xlix, no. 5 ; Part III (1906), 1, no. 5 ; Part IV (1907) li, no. 9 ; Part V (1908), lii, no. 13 ; Part VI (1909), liii, no. 21.

—— 1912 etc.,Lagenae of the South-west Pacific Ocean, from soundings taken by H.M.S. " Waterwitch", 1895. Journ. Quekett Micr. Club, ser. 2, 11, 1912, No. 70. pp. 375–434, pls. xiv–xxi. Supplementary paper, 12, 1912, No. 73, pp. 161–210, pls. xv–xviii.

—— 1918. Report on the Recent Foraminifera dredged off the East Cost of Australia. Journ. Roy. Micr. Soc., 1918, pp. 1–25, 121–153, 249–264, pls. 1–6.

Silvestri, A. 1904. Ricerche strutturali su alcune forme dei trubi di Bonfornello (Palermo). Mem. Pont. Accad. Nuovi Lincei, 22, pp. 235–276, 14 text-figs.

Silvestri, O. 1872. Le Nodosarie fossile nel Terreno subappenino Italiani e viventi nei Mari d'Italia. 11 pls., Catania.

Terquem, O. 1875 etc. Essai sur le Classement des Animaux qui vivent sur la Plage et dans les Environs de Dunkerque. 8vo, Paris, fasc. 1, 1875, pp. 1–54, pls. i–vi ; fasc. 2, 1876, pp. 55–100, pls. vii–xii ; fasc. 3, 1881, pp. 101–152, pls. xiii–xvii.

—— 1878. Les Foraminifères et les Entomostracés-Ostracodes du Pliocène supérieur de l'Ile de Rhodes. Mem. Soc. Géol. France, ser. 3, 1, pp. 1–133, pls. 1–14.

Thalmann, H. E. 1950. New names and homonyms in Foraminifera. Contr. Cushman Found. Foram. Res. 1, pts. 3 and 4, pp. 41–45.

Uchio, T. 1950. Foraminiferal study of tertiary Formation near Otaki Gas Field, Chiba Prefecture (ser. 1), *In* Natural Gas in the Vicinity of Otaki, Chiba kin, by K. Kawai and others. Journ. Assoc. Petr. Techn. 15, No. 4, pp. 151–219, text-figs. 1–25.

—— 1952. Foraminiferal assemblage from Hachigo Island, Tokyo Prefecture, with descriptions of some new genera and species. Japanese Journ. Geol. Geog. 22, pp. 145–159, pls. 6, 7, text-figs. a–c, table 1.

WALKER, G. and JACOB, E. 1798. *In* Kanmacher, F., Adams' Essays on the Microscope, 2nd. Edn. 4to, London.

WIESNER, H. 1912. Zur Systematik adriatischer Nubecularien, Spiroloculinen, Miliolinen und Biloculinen. Arch. Protist. 25, pp. 201–239. text-figs.

—— 1931, Die Foraminiferen. *In* Drygalski, E. von, Deutsche Sud-polar Exped. 1901–3. Bd. 20 (Zool. Bd. 12), pp. 53–165, Taf. i–xxiv.

WILLIAMSON, W. C. 1848. On the Recent British species of the genus *Lagena*. Ann. Mag. Nat. Hist., ser. 2, 1, pp. 1–20, pls. i, ii.

—— 1858. On the Recent Foraminifera of Great Britain. Ray Soc., London.

WRIGHT, J. 1886. Report on the Marine Fauna of the South-west of Ireland—Foraminifera. Proc. Roy. Irish. Acad., ser. 2, iv (1887) (Science), pp. 607–614.

—— 1891. Report on the foraminifera obtained off the south-west coast of Ireland during the cruise of the "Flying Falcon". Proc. Roy. Irish. Acad., ser. 3, 1 (1889–91), No. 4, pp. 460–502, pl. xx.

—— 1911. *In* Heron-Allen and Earland, 1908–11, On the recent and fossil foraminifera of the shore sands of Selsey Bill, Sussex. Journ. Roy. Micr. Soc., 1911, pp. 298–343.

WOOD, A. 1948. The structure of the wall of the test in the Foraminifera; its value in classification. Quart. Journ. Geol. Soc. CIV, pt. 2, pp. 9–252, pls. xiii–xv.

PLATE I.

Fig. 1.—*Discobotellina biperforata* n. sp. Holotype (Form 2). “*a*” side view, “*b*” edge view. × 2.

Fig. 2.—*D. biperforata* n. sp. Paratype (Form 1). “*a*” side view, “*b*” edge view. × 3.

Fig. 3.—*D. biperforata* n. sp., specimen broken in half and showing internal structure. × 4.

Fig. 4.—*Saccammina consociata* (Flint). × 28.

Fig. 5.—*Involutina* sp. × 45.

Fig. 6.—*Glomospira elongata* n. sp. Holotype. “*a*” side view, “*b*” end view. × 72.

Fig. 7.—*G. elongata* n. sp., immature test showing coiling of early whorls. “*a*” side view, “*b*” end view. × 72.

Fig. 8.—*Lituotuba minuta* n. sp. Holotype. × 72.

Fig. 9.—*Ammolagena clavata* (Parker and Jones), two-chambered specimen. × 45.

Fig. 10.—*Ammomarginulina australiensis* n. sp. Holotype. “*a*” side view, “*b*” apertural view. × 64.

Fig. 11.—*Nouria textulariformis* Hada, *armata* n. subsp. Holotype. “*a*” side view, “*b*” apertural view. × 45.

Fig. 12.—*Trochammina chitinosa* n. sp. Holotype. “*a*” dorsal view, “*b*” ventral view, “*c*” edge view. × 120.

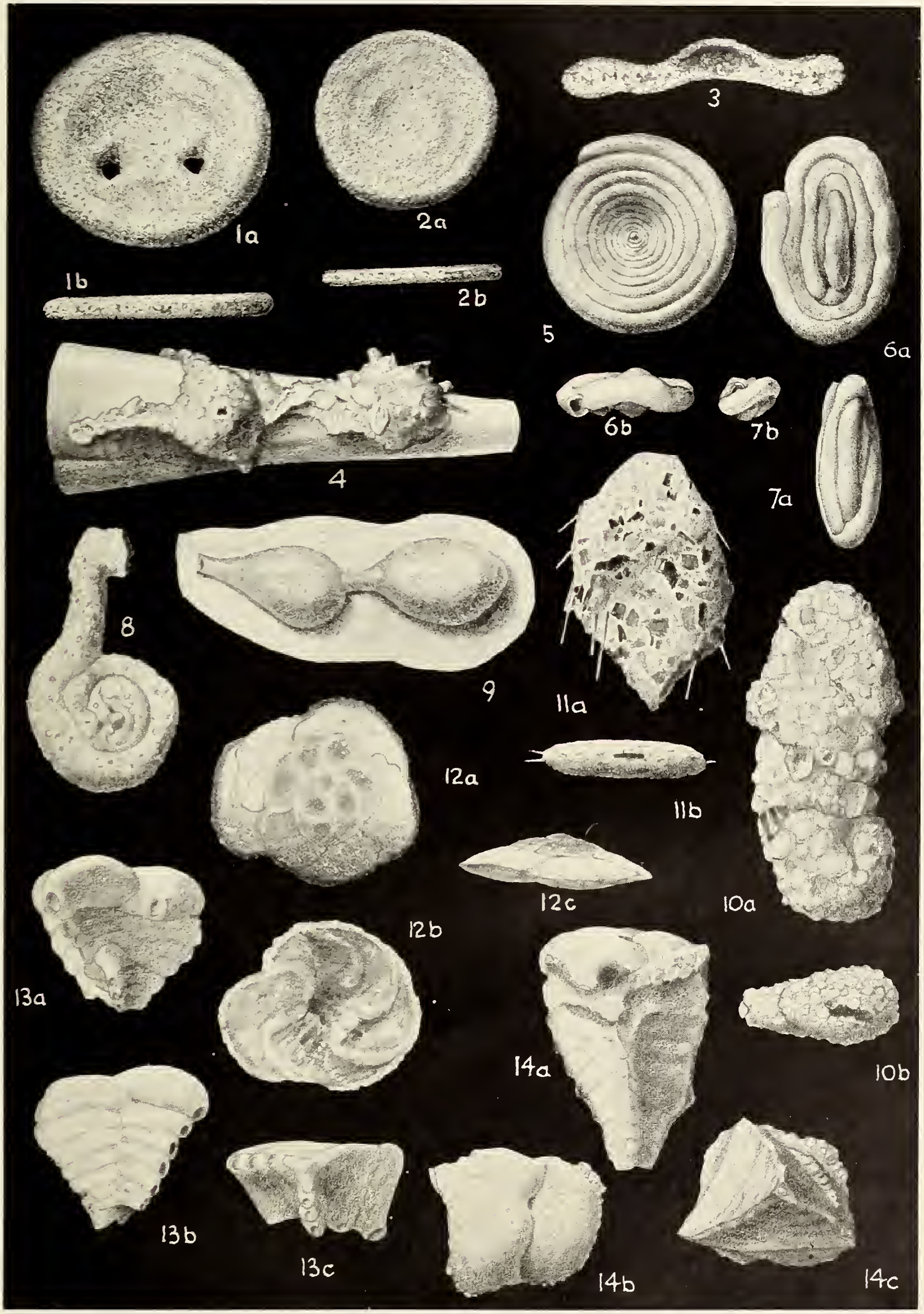
Fig. 13.—*Gaudryina* (*Siphogaudryina*) *wrightiana* Millett. “*a*” and “*b*” side views, “*c*” basal view. × 120.

Fig. 14.—*G.* (*Pseudogaudryina*) *concava* n. sp. Holotype. “*a*” side view, “*b*” apertural view, “*c*” basal view. × 45.

-1 OCT 1958
PRESENTED

BRITISH MUSEUM (NATURAL HISTORY)

PLATE I.



[*Adlard & Son, Ltd., Impr.*

PLATE II.

Fig. 1.—*Eggerella australis* n. sp. Holotype. “ *a* ” side view, “ *b* ” apertural view. × 120.

Fig. 2.—*E. polita* n. sp. Holotype. “ *a* ” side view, “ *b* ” apertural view. × 120.

Fig. 3.—*Dorothia inepta* n. sp. Holotype. Side view. × 30.

Fig. 4.—*D. inepta*, early chambers of another specimen exposed by grinding. × 50.

Fig. 5.—*Karreriella* (*Karrerulina*) *attenuata* n. sp. Holotype. Side view. × 120.

Fig. 6.—*Quinqueloculina crassicarinata* n. sp. Holotype. “ *a* ” and “ *b* ” side views, “ *c* ” apertural view. × 45.

Fig. 7.—*Q. cuvieriana* d'Orbigny, *queenslandica* n. subsp. Holotype. “ *a* ” and “ *b* ” side views, “ *c* ” apertural view. × 66.

Fig. 8.—*Q. quinquecarinata* n. sp. Holotype. “ *a* ” and “ *b* ” side views, “ *c* ” apertural view. × 110.

Fig. 9.—*Massilina subrugosa* n. sp. Side view. × 22.

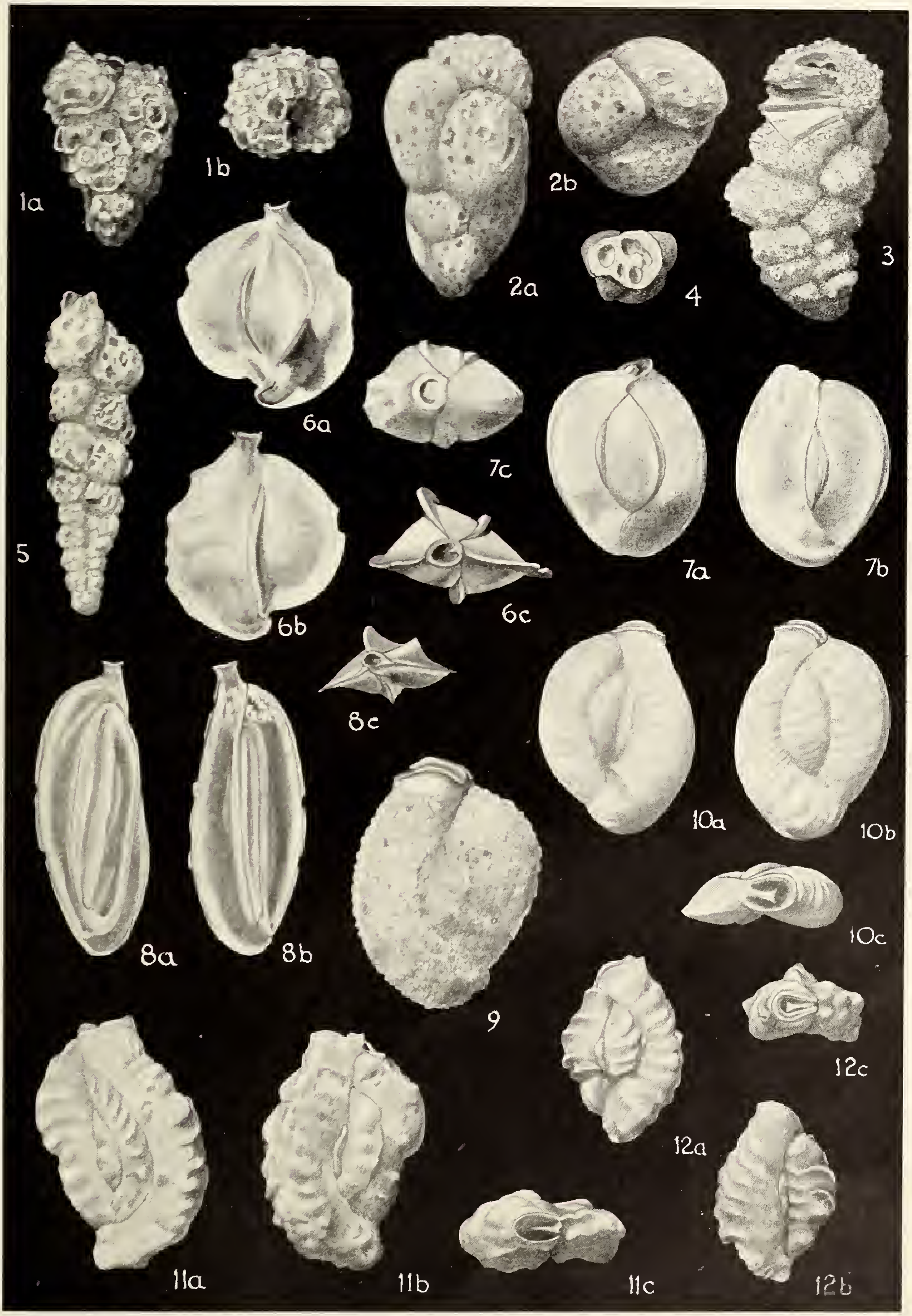
Fig. 10.—*M. secans* d'Orbigny, *tropicalis* n. subsp. Holotype. “ *a* ” and “ *b* ” side views, “ *c* ” apertural view. × 36.

Fig. 11.—*M. corrugata* n. sp. Holotype. “ *a* ” and “ *b* ” side views, “ *c* ” apertural view. × 36.

Fig. 12.—*M. corrugata* n. sp. Paratype. “ *a* ” and “ *b* ”, side views, “ *c* ” apertural view. × 36.

BRITISH MUSEUM
Z D
NATURAL HISTORY

PLATE II.



[*Adlard & Son, Ltd., Impr.*

PLATE III.

Fig. 1.—*Massilina minuta* n. sp. Holotype. "*a*" and "*b*" side view. × 120.

Fig. 2.—*M. minuta*, section through another specimen. × 120.

Fig. 3.—*Spirosigmoilina parri* n. sp. Holotype. "*a*" and "*b*" side views, "*c*" apertural view. × 105.

Fig. 4.—*S. parri*, section through another specimen. × 210.

Fig. 5.—*Articulina tricarinata* n. sp. Holotype. "*a*" side view, "*b*" apertural view. × 210.

Fig. 6.—*A. tricarinata*, side view. × 210.

Fig. 7.—*A. sagra* d'Orbigny. Side view. × 72.

Fig. 8.—*A. queenslandica* n. sp. Holotype. Side view. × 120.

Fig. 9.—*A. queenslandica*. Side view. × 120.

Fig. 10.—*A. queenslandica*. Side view. × 120.

Fig. 11.—*Hauerina pacifica* Cushman, *rugosa* n. subsp. Holotype. "*a*" and "*b*" side views, "*c*" apertural view. × 55.

Fig. 12.—*Triloculina littoralis* n. sp. Holotype. "*a*" and "*b*" side views, "*c*" apertural view. × 85.

Fig. 13.—*T. quadrata* n. sp. Holotype. "*a*" and "*b*" side views, "*c*" apertural view. × 48.

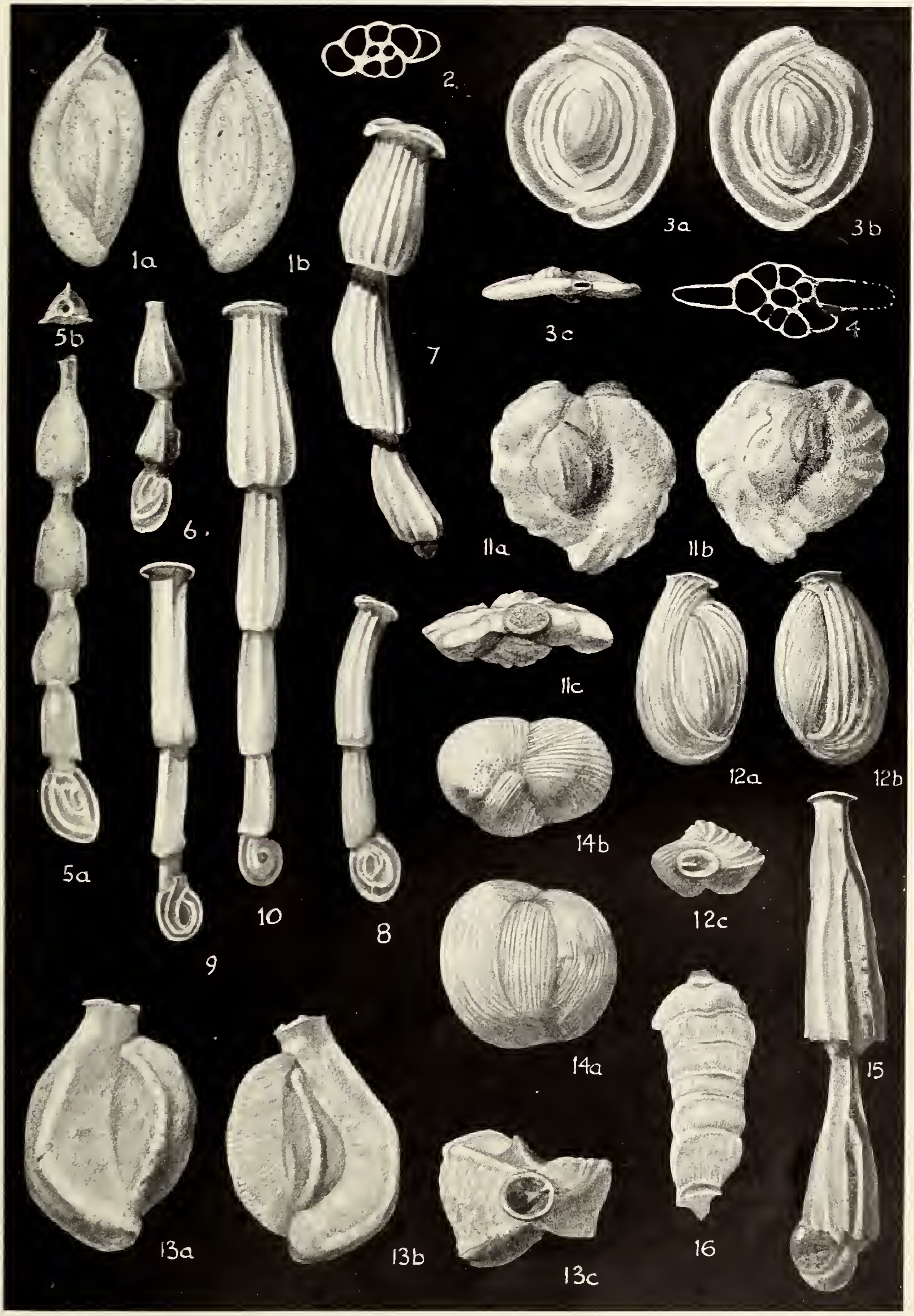
Fig. 14.—*T. sublineata* (Brady) ? "*a*" side view, "*b*" apertural view. × 48.

Fig. 15.—*Nodophthalmidium gracilis* n. sp. Holotype. Side view. × 115.

Fig. 16.—*Cornuspirella diffusa* (Heron-Allen and Earland). × 48.

GREAT BARRIER REEF EXPEDITION 1928–29.

Brit. Mus. (*Nat. Hist.*).　　Reports, Vol. VI, No. 6.　　PLATE III.



[*Adlard & Son, Ltd., Imp.*

PLATE IV.

Fig. 1.—*Ophthalmidium circularis* (Chapman) *tropicalis* n. subsp. Holotype. "*a*" side view, "*b*" apertural view. × 120.

Fig. 2.—*Planispirinella involuta* n. sp. Holotype. "*a*" side view. "*b*" apertural view. × 90.

Fig. 3.—*Nubeculopsis queenslandica* n. gen., n. sp. Holotype. "*a*" ventral view, "*b*" dorsal view, "*c*" apertural view. × 70.

Fig. 4.—*Fischerina pellucida* Millett. × 115.

Fig. 5.—*Globulotuba entosoleniformis* n. gen., n. sp. Holotype. "*a*" side view, "*b*" aboral view. × 115.

Fig. 6.—*Glandulina semistriata* n. sp. Holotype. "*a*" side view, "*b*" aboral view. × 115.

Fig. 7.—*Buliminella latissima* n. sp. Holotype. "*a*" and "*b*" side views, "*c*" apertural view. × 160.

Fig. 8.—*Ungulatella pacifica* Cushman. × 160.

Fig. 9.—*Bulimina oblonga* n. sp. Holotype. "*a*" and "*b*" side views, "*c*" apertural view. × 115.

Fig. 10.—*Globobulimina australiensis* n. sp. Holotype. "*a*" side view, "*b*" apertural view, "*c*" aboral view. × 55.

Fig. 11.—*Mimosina rimosa* Heron-Allen and Earland. × 140.

Fig. 12.—*Trimosina milletti* Cushman, *multispinata* n. subsp. Holotype. Side view. × 115.

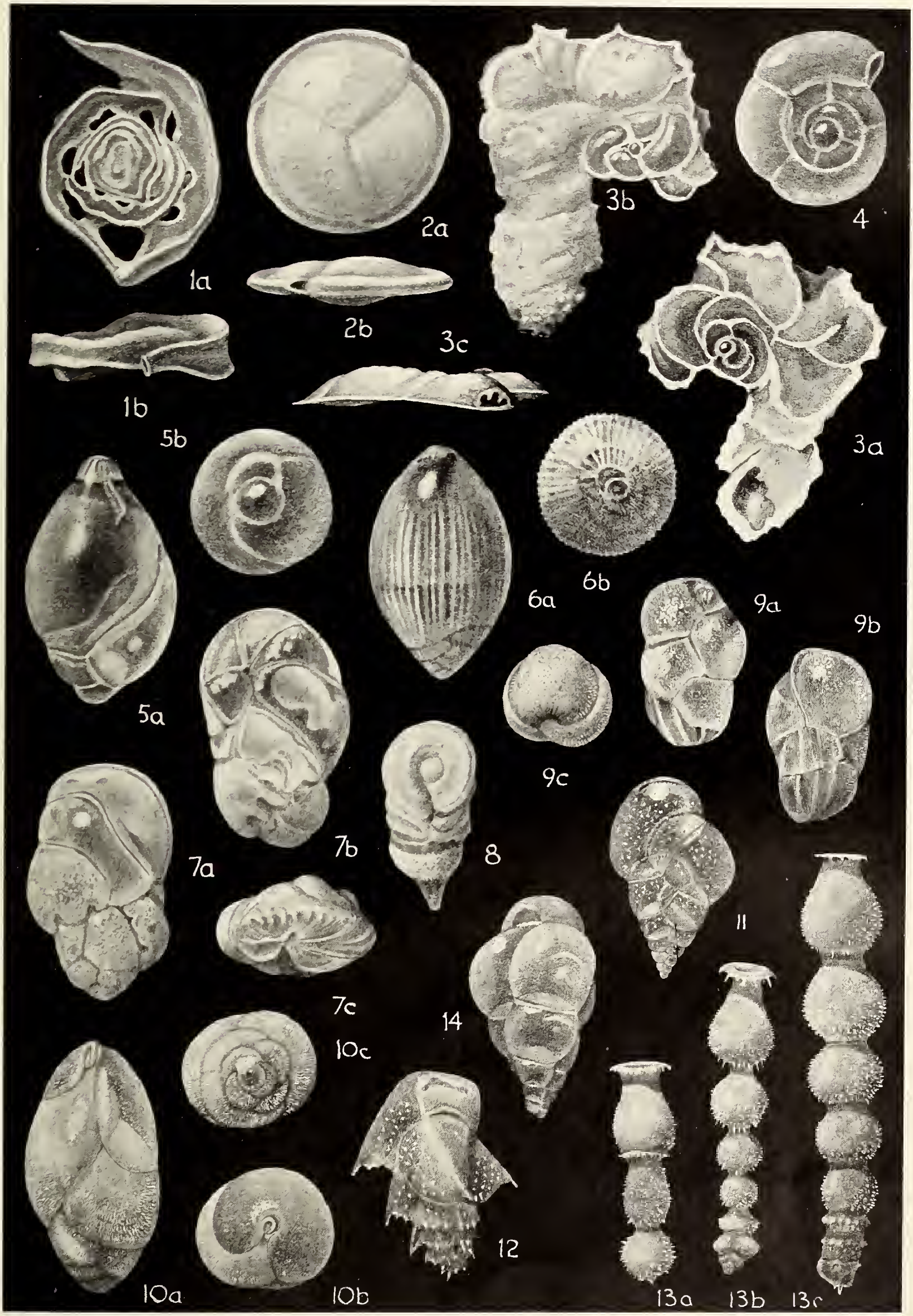
Fig. 13.—*Siphogenerina virgula* (Brady). "*a*" megalospheric specimen, "*b*" and "*c*" microspheric specimens. × 90.

Fig. 14.—*Gümbelitria vivans* Cushman. × 215.

BRITISH MUSEUM NATURAL HISTORY

GREAT BARRIER REEF EXPEDITION 1928–29.

Brit. Mus. (Nat. Hist.). REPORTS, VOL. VI, No. 6. PLATE IV.



[*Adlard & Son, Ltd., Impr.*

PLATE V.

Fig. 1.—*Bolivina alata* Seguenza, *fimbriata*, n. subsp. Holotype. "*a*" side view, "*b*" apertural view. × 115.

Fig. 2.—*Loxostomum convallarium* (Millett). × 115.

Fig. 3.—*Bifarina elongata* Millett. × 115.

Fig. 4.—*B. queenslandica* n. sp. Holotype. "*a*" side view, "*b*" apertural view. × 115.

Fig. 5.—*Discorbis subvesicularis* n. sp. Holotype. "*a*" dorsal view, "*b*" ventral view, "*c*" apertural view. × 75.

Fig. 6.—*Conorbella earlandi* n. sp. Holotype. "*a*" dorsal view, "*b*" ventral view, "*c*" apertural view. × 160.

Fig. 7.—*Discorinopsis tropica* n. sp. Holotype. "*a*" dorsal view, "*b*" ventral view, "*c*" apertural view. × 70.

Fig. 8.—*Patellinella carinata* n. sp. Holotype. "*a*" side view, "*b*" dorsal view, "*c*" ventral view. × 115.

Fig. 9.—*Epistomariella milletti* n. sp. Holotype. "*a*" dorsal view, "*b*" ventral view, "*c*" apertural view. × 115.

Fig. 10.—*Streblus convexus* n. sp. Holotype. "*a*" dorsal view, "*b*" ventral view, "*c*" apertural view. × 55.

Fig. 11.—*Robertina australis* n. sp. Holotype. "*a*" side view, "*b*" apertural view. × 115.

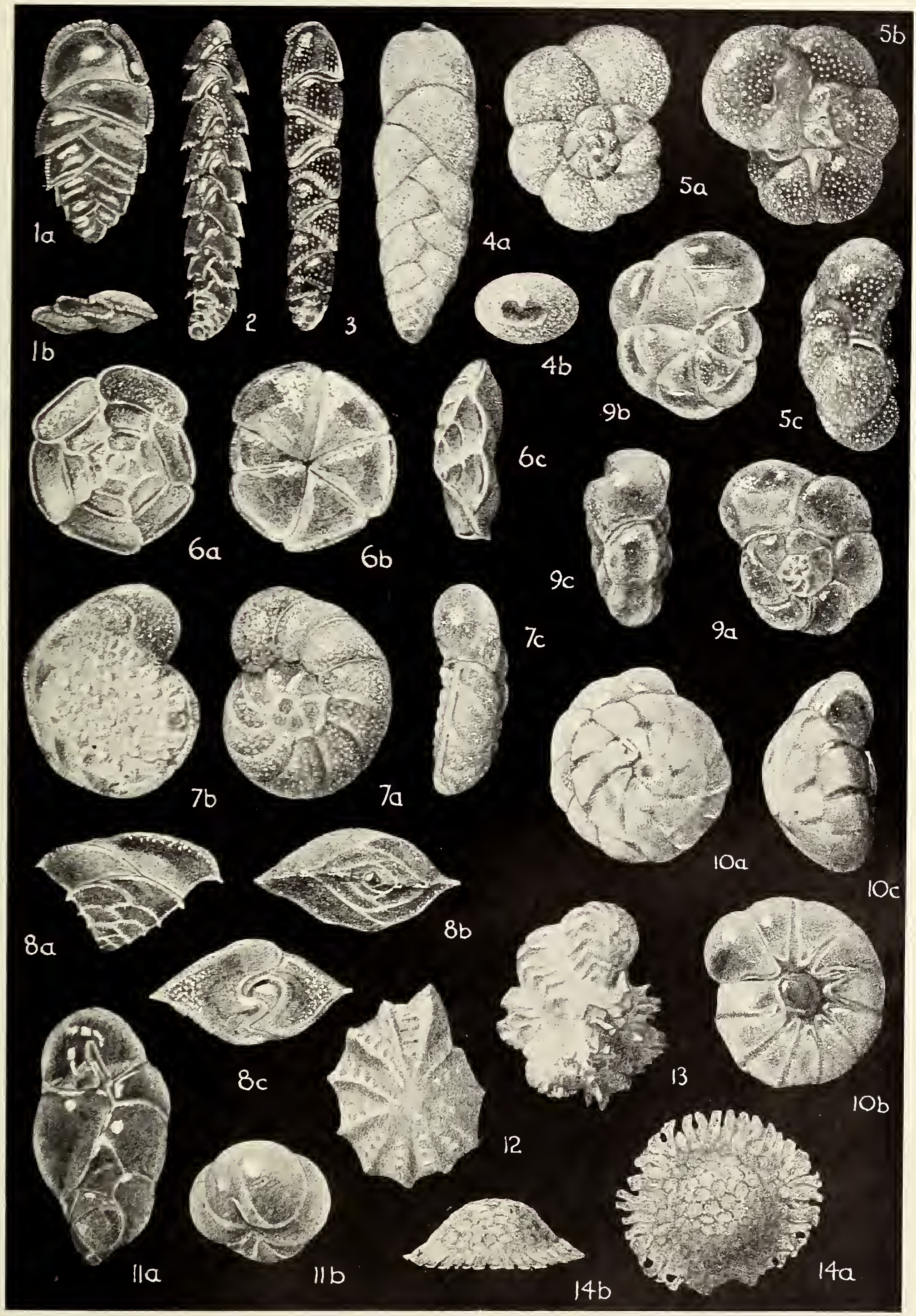
Fig. 12.—*Elphidium* sp. aff. *josephinum* (d'Orbigny). × 100.

Fig. 13.—*E. pacificum* n. sp. Side view. × 100.

Fig. 14.—*Gypsina fimbriata* (Chapman). "*a*" view from above, "*b*" edge view. × 22.

BRITISH MUSEUM
NATURAL HISTORY

PLATE V.



[*Adlard & Son Ltd., Impr.*